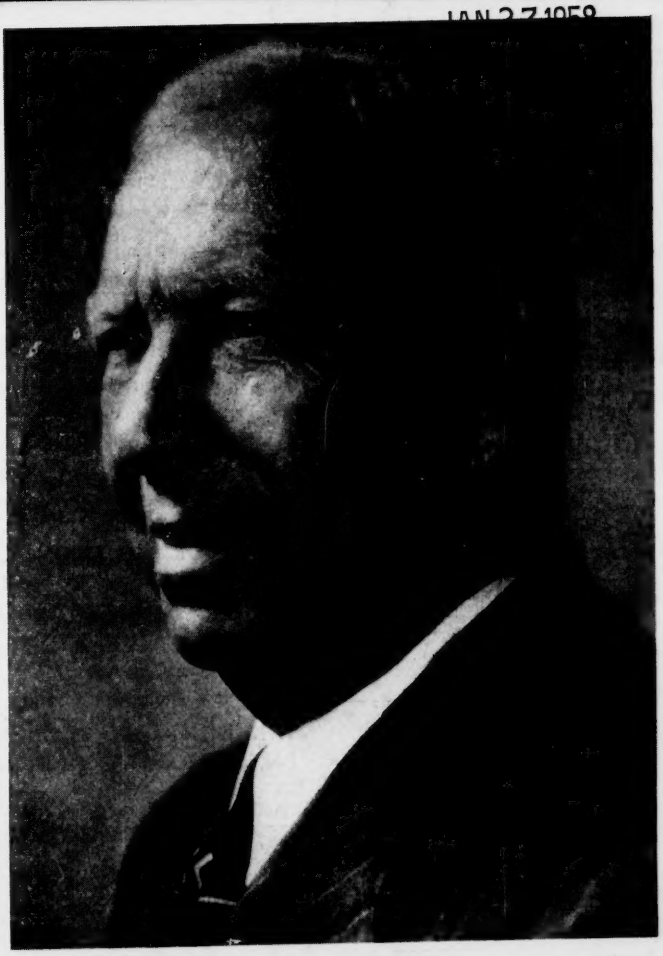
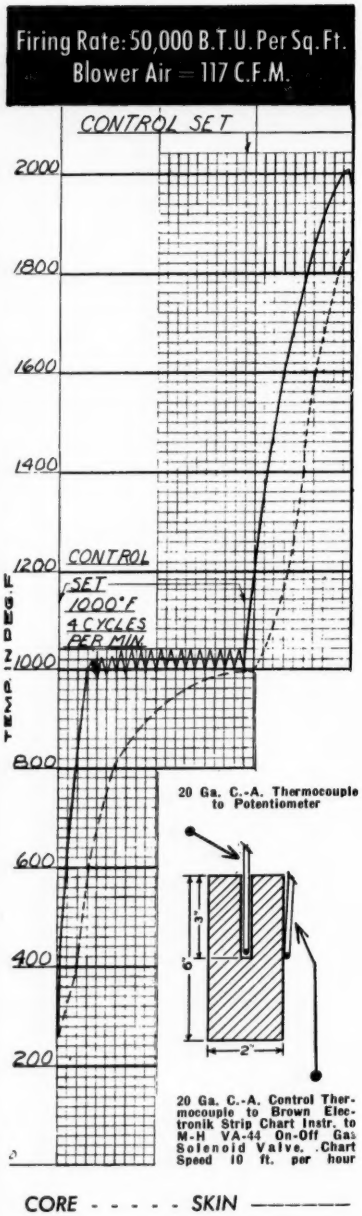
Metals Review

JAN 27 1958



INSTANTANEOUS HEAT with Holden Combustion System

INSPECT THIS PROVEN OPERATION AT OUR DETROIT PLANT



TEST DATA

1. A 20 gage thermocouple was welded to the outside of the 2" diameter x 6" long piece. A hole was drilled to accommodate a 20 gage thermocouple to record the inner temperature and the time differential.

2. The heating condition with the Lumenous Wall face firing rate at 50,000 BTU's per sq. ft. in the following temperature ranges:

   A. Up to 1000° F. (10 minutes lag 800° to 1000° F.)
   B. Up to 1975° F. (3 minute lag)
   C. 1975° to 2275° F. (3 minute lag)

OTHER NEW HOLDEN DEVELOPMENTS

Automatic Conveying System

1. A new automatic conveying system—Open for Inspection at Our Plant—that can be used for Salt Bath or Automatic Plating.

2. This conveying system can be used on In-Line Production or Return with a 30% savings on capital investment.

Aluminum Coating of Steel or Alloys

1. Furnace unit preheats metal.
2. New Holden flux over aluminum.
3. New method of bonding after aluminum coating.
4. Improves many alloys 3 to 1 in service life.
5. We can process pilot plant production.

YOUR INVITATION TO INSPECT—THREE NEW HOLDEN DEVELOPMENTS

1. New Method of Instantaneous Combustion.
2. New Conveyor System for Salt Baths or Plating—Saves 10% to 30% on Floor Space.
3. New Aluminum Coating Method for Steel and Alloys.

WHY NOT ALLOCATE 2 HOURS OF EXTRA TIME AT DETROIT AS A PART OF FORWARD PLANNING.

THE A. F. HOLDEN COMPANY

3 F.O.B. Points for Holden Metallurgical Products

EXECUTIVE OFFICES AND PLANT
• 14341 SCHAEFER HIGHWAY,
DETROIT 27, MICHIGAN

EASTERN PLANT
• 460 GRAND AVENUE,
NEW HAVEN 13, CONN.

WESTERN PLANT
• 4700 EAST 48th STREET
LOS ANGELES 58, CALIF.

Metals Review

The News Digest Magazine

January 1958
Vol. XXXI, No. 1

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A.S.M. MEDAL FOR THE ADVANCEMENT OF RESEARCH AWARDED TO McKENNA

Citation for Roy Carnegie McKenna

Chairman of the Board, Vanadium-Alloys Steel Co.

To President Clark, Distinguished Guests, Fellow Members, Ladies and Gentlemen:

I have been asked to present this Citation accompanying the ASM Medal to be awarded for the Advancement of Research to my long time friend and business competitor Roy Carnegie McKenna, chairman of the board of the Vanadium-Alloys Steel Co.

I am deeply appreciative of this opportunity to recognize my lifetime competitor and show my respect and the respect that is properly due him in presenting this citation.

Behind this Citation is the fact that for as long as the American Society for Metals has been promoting the arts and sciences relating to the metalworking industry, metallurgical research has been a prime function of Mr. McKenna's company, the Vanadium-Alloys Steel Co. Mr. McKenna has been responsible for a dedication of his company to outstanding research activity.

At the age of 32, Mr. McKenna became president of his company. This was in 1915, five years after the company had been founded. World War I was being waged and his desire to establish a permanent research department, based on an awareness of its necessity for future progress in the field of tool and special steels, had to await the end of the war. In the spring of 1919 he organized a metallurgical and research department. At the same time he was instrumental in organizing the Pittsburgh Chapter of the American Society for Metals, an effort based on his belief in the growing importance of metallurgical science to the metals industry.

It will be recalled that the technical work in most steel companies at that time was conducted by a so-called chemistry department or chemical laboratory. The establishment of a department exclusively devoted to physical metallurgy research, staffed by men trained in the new but growing science, was an innovation—particularly among manufacturers of primary metals and metal products—and I might add that many thought at the time that Mr. McKenna was indulging in a luxury whim.

The second outstanding contribution of Mr. McKenna at the time was his belief in the delegation of responsibility to qualified heads of his company's departments. For example, the responsibility for the research department was completely separated from the operating, sales, or chemical departments; from the beginning it operated independently in charting its course for progress. It should be added that Mr. McKenna has time and again demonstrated his loyalty to those to whom he delegated responsibilities even when results were not immediately forthcoming. The idea of separate organizational status was later adopted by others and ultimately by the tonnage steel industry.

Papers published within the first three years of the new department's operation set up and disclosed for the first time the detailed chemical analyses of toolsteels and Mr. McKenna was an author of one of these early papers. The formulation of high-carbon, high-chromium steels in the 1920's, the detailed study in the 1930's of the carbides in high speed steels as reported by Gill and an ASM Campbell Memorial Lecture, the development of the widely used air hardening hot work die steel in 1933, the investigations on the transformation characteristics and partition of elements in high-speed steels during the 1940's, the development of the high-carbon, high-vanadium steels now known as "super high speed steels" in the 1935-1945 decade, and the postwar introduction of the free machining toolsteels are achievements which have resulted from the research activities encouraged and promoted by Mr. McKenna.

Another specific program was started in July 1928 by Mr. McKenna to improve cemented carbide cutting materials, which over a period of ten years led to the formation of two companies successfully manufacturing such improved material, namely, the Vascoloy-Ramet Corp., and Kennametal Inc.

A fine new research laboratory building was built in 1945 and metallurgical research groups have been organized in the company's behalf in Canada, France and Italy.

In addition to the foregoing, since World War II, under Mr. McKenna's leadership, the metallurgical department of his company successfully devised a process for making pre-alloyed steel powders by atomization and other means, which is now in commercial operation.

The foregoing, in brief, I believe demonstrates the truth-seeking urge with the resulting creativeness that is the very essence of Mr. McKenna's nature and warrants this Citation.

For this record and these achievements the Board of Trustees of the American Society for Metals has awarded its 1957 Medal for the Advancement of Research to Roy Carnegie McKenna of Latrobe, Pa. The award is in recognition of his contributions toward the establishment of effective and independent research in the metal sciences and in recognition of his support and belief in the exchange of information in metallurgical technology, especially in the field of tool materials and specialty alloy steels.

In the absence of Mr. McKenna due to illness, **James P. Gill,** former president A.S.M., and associate of Mr. McKenna, accepted the Citation in his behalf.

Citation by Arthur Clarage,
Columbia Tool Steel Co.

Williams Retires as President of Battelle

Battelle Memorial Institute has announced that Clyde Williams retired as president of Battelle Memorial Institute on Jan. 1. Dr. Williams has taken this step to enable him to engage more actively in private business. He has established a new company and has completed arrangements to assist several industries with their technical and business problems. He will, however, continue to serve the Institute as a member of the Board of Trustees and in an advisory capacity.

Dr. Williams joined the staff of Battelle Memorial Institute in 1929. He became director in 1934 and in the subsequent years was responsible more than any other individual for the dynamic growth of Battelle. Research has become a powerful element in the technological development of the country, and the Institute, under his leadership, participated actively in this research effort. He originated many of the features which characterize contract research and which have been adopted by other research organizations. He was responsible for the development of many novel concepts in research management and was able to apply them, not only within the Institute, but in his extensive public service. Not the least of his accomplishments has been the development of an able staff which will carry on the work of the Institute.

Chicago-Western Presents Gift to Headquarters Building Fund

James F. Schumar (Left), Chairman of the Chicago-Western Chapter, Is Shown Presenting a Check for $1000 to Be Used for the National Office Building Fund, to W. H. Eisenman, National Secretary, While R. W. Hanzel, Vice-Chairman, Chicago-Western Chapter, Assists in the Presentation

Compliments

To PAUL D. FROST, a specialist in light metals research at Battelle Memorial Institute, on being awarded the 1957 Metal Treating Institute Achievement Award for his article concerning heat treatment of titanium and a subsequent lecture based upon the article. Mr. Frost is a member of the Columbus Chapter.

♦ ♦ ♦

To MAXWELL GENSAMER, of Columbia University, who has been named Howe Memorial Lecturer for 1958 by A.I.M.E. Dr. Gensamer, who received the Howe Medal of the American Society for Metals (1932), and who was a Campbell lecturer (1945), is a member of the New York Chapter.

♦ ♦ ♦

To JOHN F. THOMPSON, chairman of the board, International Nickel Co., who has been chosen to receive A.I.M.E.'s Charles F. Rand Memorial Medal for 1958 for his leadership of a mining and metallurgical enterprise which has contributed to free world strength, for his administrative skills which have furthered the progress of the nickel industry, for his vision in stimulating scientific research, for demonstrating the value of a technical education combined with broad interests and human understanding.

The following exchange of letters between officers of the Chicago-Western Chapter and National Headquarters A.S.M. presents the story of a gift:

To: W. H. Eisenman

Dear Bill:

"The Officers and Executive Committee of the Chicago-Western Chapter of A.S.M. wish to present to you this check for $1000 to be used for the A.S.M. National Office Building Fund. How the moneys are to be used in the new national office building is to be left completely to your discretion. The Officers and Executive Committee of the Chicago-Western Chapter have deeply appreciated the help, guidance and assistance that the national office has given us during our organization and growth as an A.S.M. chapter. This check, then, is in appreciation of that assistance". Signed J. F. Schumar, Chairman.

To: J. F. Schumar

Dear Jim:

"I have the honor to acknowledge receipt of your fine letter of Nov. 1 from the Officers and Executive Committee of the Chicago-Western Chapter of the A.S.M. presenting their check No. 265 for $1000 to be used for the A.S.M. National Office Building Fund.

"This letter is to let you know that all of us at headquarters, as well as the Board of Trustees, are deeply touched by this magnificent contribution for the new building, and we wish to assure you that it will be a joy to all to be able to have some definite part of the building marked as a contribution from the Chicago-Western Chapter which will be a constant reminder of the pleasure we have all experienced in serving your Chapter.

"In due time we will let you know how we used this money and will give proper credit to your Chapter for your outstanding contribution". Signed W. H. Eisenman.

—Progress Through Metal Science—

Letter to A.S.M.

The following letter was received from an appointee selected to serve on the Transactions Committee.

"I am happy to accept appointment to the Transactions Committee for three years effective Jan. 1, 1958.

"The responsibility and importance of the work of this committee are very great and I am happy to try to make a worthwhile contribution, as so many men have done in the past. As an example of the loyalty and appreciation which members have for the Society, many of my associates have offered to help me in doing this work. Speaking personally, I have received so many benefits from A.S.M. membership that it is a real pleasure to help in carrying forward the good work of the Society".

Thank you O.O.M.—it is men like you who make the A.S.M. tick!

Describes Coatings for Welding Electrodes

H. F. Reid (Left), Manager, Technical Service Division, McKay Co., Talked on "Coatings for Welding Electrodes" at a Recent Meeting Held by Rocky Mountain (Denver) Chapter. He is shown with chairman James Blackledge, manager of the metallurgy division at the Denver Research Institute

Speaker: H. F. Reid
McKay Co.

Members of the **Rocky Mountain (Denver) Chapter** recently heard a talk by Harry F. Reid, manager, Technical Service Division, McKay Co., on "Coatings for Welding Electrodes".

Last year the United States produced 650,000,000 lb. of welding electrodes and yet, until recently, the industry had been shrouded with secrecy because of intense competition and proprietary developments. The need for familiarization of industrial users to enable more widespread use of common and special-purpose electrodes necessitated interchange of information.

Mr. Reid stressed the important points in considering electrode coatings, namely: determination of a-c. or d-c. characteristics of the rod; control of amperage, voltage, etc.; provision for insulation; and control of the arc. Not only must the coating perform the above functions, but additions to the coating during production must be made judiciously to prevent unstable arc conditions and to provide adequate conditioning of the weld puddle for the production of sound welds. The proper balance of gas scavengers, slagging constituents, binders, fluxes, alloying elements and extrusion aids must be maintained. An important factor influencing weld deposits is the transfer of alloying coating materials through the arc to the weld. Without this transfer, the use of welding would be restricted considerably and its present state of development probably would have been impossible.

The various constituents used for coating electrodes and their functions were described. Binders and extrusion aids include bentonite and clay to provide slippage and fluidity and talc and mica to help in the extrusion of the rod. Invert sugar and starch-dextrin additions help to retain moisture and prevent cracking during electrode drying cycles. Arc stabilizers, such as TiO_2, potassium titanate, ilmenite and $LiCO_3$, hold their ionization characteristics and are vitally necessary. Flux and slag modifiers include $CaCO_3$ and silica flour which help to adjust the slag, micaceous hematite for fluxing purposes, and zircon and zirconia to raise the freezing point and melting point of the slag. Metallic alloy additions are usually made. Recently, powdered metal additions have been shown to hold down dilution and increase the rate of deposition and rate of burn-off.

Generally, two types of electrode coatings are manufactured—gas producing and slag producing. The former type is controlled by cellulose materials in the coating while the latter form contains less gas-producing and more slag-forming constituents. The advantages of both types of coatings were presented by Mr. Reid.

The many innovations and developments in the production of coated electrodes during and subsequent to World War II were described in some detail. Such developments as iron powder electrodes and low-hydrogen electrodes show the increased development of coating technology.—**Reported by Dick Agricola for Rocky Mountain Chapter.**

Speak on European Mill Technology

Walter D. France, Assistant Director Metals Research, and Earle W. Lovering, Metallurgical Engineer, Scovill Manufacturing Co., Presented a Talk on "European Nonferrous Mill Technology" at a Meeting of New Haven Chapter. Shown, from left: Roy S. Pratt, technical chairman; Mr. Lovering; Mr. France; and Kenneth L. Tingley, the vice-chairman of the Chapter

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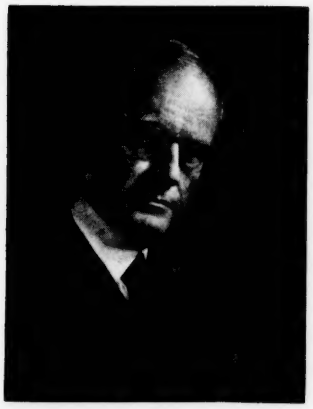


Dr. Merica, Honorary Member, A.S.M., Dies

PAUL DYER MERICA, 68, who retired as president of The International Nickel Co. of Canada, Ltd., in 1954, but continued to serve the company on important projects and as consultant to the officers, died on Oct. 20 after a heart attack.

Dr. Merica was a director of the International Nickel Co. of Canada, Ltd., and its United States subsidiary, The International Nickel Co. Inc., and of the American Metal Co., Ltd., Babcock & Wilcox Co. and Whitehead Metal Products Co. Inc.

He first became associated with International Nickel in 1919 and served the company as director of research, assistant to the president, director, vice-president and executive vice-president, retiring from the last position in 1954.

For his contributions in the field of metallurgy and outstanding leadership in physical metallurgy, Dr. Merica was awarded the James Douglas Medal in 1929, the John Fritz Medal in 1938, the Institute of Metals Medal in 1941, the Franklin Institute Medal in 1942 and A.S.M.'s Gold Medal in 1951. He was a member of the National Academy of Sciences, a fellow of the American Association for the Advancement of Sciences, and a member of several national and international scientific organizations. In 1955 Dr. Merica was made an honorary member of the American Society for Metals, the 22nd person to be so honored, joining a roster of distinguished scientists and engineers, both past and present. He was also an honorary member of the American Institute of Mining and Metallurgical Engineers, of which he was a former vice-president and director.

Dr. Merica was born in Warsaw, Ind., in 1889. He attended De Pauw University from 1905 to 1907 and received an A.B. degree from the University of Wisconsin the following year. He received his Ph.D. degree from the University of Berlin in 1914. From 1914 to 1919 he was associated with the metallurgical division of the U. S. Bureau of Standards in Washington, during which time he carried out a number of researches on Duralumin and other aluminum alloys and developed his theory of the precipitation hardening of metals and alloys.

He was the author of many technical papers and articles and held honorary degrees from De Pauw and Lehigh Universities and Stevens Institute of Technology.

ARE YOU QUALIFIED FOR FURTHER EDUCATION?

Anton de S. Brasunas, Director
A.S.M. Metals Engineering Institute

Surveys have shown that failure or success in college can be predicted fairly accurately by the "IQ yardsticks". We're told that an IQ of 110 is necessary for a student to succeed. Yet students with low IQ's have graduated and become successful in life. On the other side of the ledger, students with high IQ's have been known to fail. We can only conclude that more than merely an adequate IQ is necessary for success. That other quality, even more important in many respects, might be called *desire to succeed*. People want *to get ahead in life* for the sake of economic security, personal pride, or various other reasons.

Anyone with a son or daughter of college age will be quick to agree that education costs money. The price of a college education has risen sharply in the past few years, and this factor alone is responsible for many high-school graduates of "college caliber" choosing jobs rather than college after graduation. The choice between college or a job depends on your accurate assessment of the "value" of an education. Dollar value can be demonstrated very easily. The average metallurgist has a lifetime earning capacity of about $420,000, whereas the man with a high-school education earns only $265,000 during his working life. Thus, an investment of as much as $10,000 for a college education would yield an excellent financial return. Any expenditure for education, whether for college, night school, or a home study program, is certainly money well spent.

Financial gain is only one of the advantages. Educational achievement brings personal satisfaction and on-the-job recognition. In fact, I'd like to say that you owe it to yourself and to the security of your family and your country to extend your technical knowledge. President Eisenhower is now studying an incentive system to encourage our qualified youth to pursue scientific careers. Many of us already in metallurgical industries have learned that employers also encourage our education by means of in-plant training programs and subsidized home study, such as the courses provided by the Metals Engineering Institute.

It is unfortunate that once the average American loses contact with the classroom, he finds it difficult to continue his education. True, we read about the woman who finally got her high-school diploma at 67, or the man who graduated from college with his son, but these instances are rare. Popular as many night schools and correspondence schools are, there are far too many individuals who fail to continue with their education. The reasons are numerous but they can be boiled down to the simple fact that it is much easier to spend an evening before the television set or "out on the town" than to curl up in a quiet corner with a book, attend a technical meeting or study in a planned manner.

No one, whether he is a college graduate or not, should be content with what he now knows. The field of metallurgy is constantly developing new techniques, alloys and ideas with which workers in industry should be familiar. This applies to those at the top of the ladder as well as those on the bottom rung. Whether your IQ is 70 or 150, you are certainly able to *learn a little more* and probably *a lot more*. Even a little more can and often does make a big difference.

In the field of metallurgy, A.S.M. has established the Metals Engineering Institute (see page 74), a home study school to help persons in industry, whether high school or college graduate, to become better informed on specific metallurgical subjects. A few correspondents have written that they're too old to study again. My reply is that you're old *only* when you think you are!

My answer to the question which forms the title of this article is a resounding YES!

As an indication of the tremendous dissemination of engineering information, a compilation shows that in one year the A.S.M. collected, edited, published and distributed over *one hundred million pages* of metallurgical information.

Metallurgical News and Developments

A Department of *Metals Review*, published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Devoted to News in the Metals Field of Special Interest to Students and Others

Hot Spinning—An advanced process for hot spinning thick titanium alloy hemispheres by methods suitable for economic production quantities has been announced by Titanium Fabricators Inc.

New for the Jet Age—The latest jet-age application of stainless steel, in corrosion-resistant cases for jet aircraft storage batteries, has been announced by Republic Steel Corp. First installations of the stainless-sheathed, nickel-cadmium batteries are being made on the six engine B-47 intercontinental bomber and the F-104 "Starfighter" ultrasonic interceptor of the Air Force. The batteries, produced by Sonotone Corp., have withstood heat and cold from −65° F. to 165° F., give military jets "self-starting" ability since all six engines of the B-47 can be started on any air base in the world without auxiliary equipment; the battery in the F-104 is capable of supplying several air starts in case of flameout.

Strip Coating—A new type of strip coating, Strip-Kote, has been developed by Chemical Consulting Service of Milwaukee. Strip-Kote is a high solid, milky colored, plastic emulsion which when dry gives a transparent, tough film for protecting smooth and wrinkled metal finishes, stainless steel, polished aluminum, plastic, marble and glass surfaces from being marred or scratched during processing, shipment or storage.

New Lab—The addition of a metallurgical laboratory to its quality control facilities has been announced by Wallingford Steel Co. Complete with metallographic, analytical and special testing sections, a library and conference room, this new laboratory provides Wallingford's metallurgists with the equipment they require to perform quality control functions.

Wear Resistant Material — Devcon Corp. announces development of Devcon WR, a material which outwears steel 60 to 1, yet can be cast without heat or pressure. This wear-resistant, self-lubricating material has been used successfully for such applications as guides on textile machinery, low-speed bearings, building up surfaces subject to severe wear, making duplicating masters and forming dies. It is supplied in paste form and, upon the addition of a hardening agent, it becomes a syrupy liquid which can be cast or poured into a variety of shapes. Two hours after the addition of the hardening agent, it cannot be machined except with carbide or similar tools.

Electronic Device — Development of the solion, an electronic device that may replace the transistor at frequencies below 100 cycles per sec., is being carried on by National Carbon Co. and Texas Research Associates. Based on both electrochemical and fluid flow principles, the solion is extremely sensitive, and its low power requirements make it ideal for remote and unattended devices. When an alternating pressure is applied to the device, iodine ions in solution are forced into contact with platinum electrodes, and the ensuing electrochemical reaction releases electrons and causes a correspondingly large increase in the flow of electrical current in an external circuit.

Spring Bibliography — An extensive bibliography of springs is available in limited quantities to technical and engineering libraries requesting them from Kent Putnam, Associated Spring Corp., Bristol, Conn. Interested parties should send their address and position or title on company letterhead with the request.

Quality Control Course — The 11th annual short course in "Quality Control by Statistical Methods" will be offered by the College of Engineering, University of Illinois, from Mar. 10 through Mar. 20, 1958. For information write to: John A. Henry, Room 205, Mechanical Engineering Laboratory, University of Illinois, Urbana, Ill.

Permanent Protection—An automatic electrical system which permanently protects ships' hulls and propellers against corrosion has been developed by Charles Engelhard, Inc. Called CAPAC, the impressed-current cathodic-protection device safeguards ships both at sea and at dockside. It is useful also for oil towers, radar towers, tidal hydro-electric turbines and pipelines carrying sea water for cooling purposes to oil refineries, steam plants and other industrial installations.

World Trade Fair—The 1958 United States World Trade Fair will be held at the New York Coliseum from May 7-17, 1958. In last year's Fair, 43 nations participated and a total of 3000 exhibitors displayed products and raw materials from 60 countries.

Instructors Seminar — A three-day meeting, to be held from June 19-21 at Case Institute of Technology, will provide instructors in foundry and patternmaking at high schools and vocational schools with information they need to keep their methods and courses in line with current industrial progress. The course is sponsored by the American Foundrymen's Society.

Increases Capacity — The Utica Metals Division of Kelsey-Hayes Co. has scheduled completion of its new plant for the production of vacuum induction melted alloys for early January.

Invites Papers — The American Society of Tool Engineers has issued an invitation for papers to be presented at the Semi-Annual Meeting and Western Tool Show to be held in September in Los Angeles. Each proposal should include an outline of the paper, the author's name, title and affiliation. They should be sent to: L. S. Fletcher, Program Director, A.S.T.E., 10700 Puritan Ave., Detroit 38, Mich.

Initiate Public Relations Program—At the first annual meeting of the newly organized Midwest Job Galvanizers Association, members passed a resolution initiating an educational program on the art of hot-dip galvanizing. The program will provide a symposium treatment of high-quality hot-dip galvanizing and will include presentation of technical papers, informal discussions of exhibits and photographs. Meetings will be held in Chicago, Detroit and other midwestern areas served by members of the Association.

Describes Glass-Ceramics At Southern Tier Meeting

Speaker: W. W. Shaver

Corning Glass Works

"Pyroceram" was the topic of a talk given by William W. Shaver, manager of the Atomic Energy Division, Research and Development Section, Corning Glass Works, at a meeting held by the **Southern Tier Chapter.**

Pyroceram is the name given by the Corning Glass Works to extremely hard, fine-grained glass-ceramics formed from special glasses. An entire family of these new materials, covering a wide range of physical properties, is being developed.

A glass-ceramic is essentially a crystalline material formed from a noncrystalline glass. A glass batch containing one or more nucleating agents is melted, formed and cooled. Subsequent heat treatments cause the nucleating agents to form billions of submicroscopic crystallites per cubic millimeter of Pyroceram, each crystallite acting as a center of crystal growth as heat continues. The end product, after heat treatment, is a fine-grained crystalline material, nonporous and harder than most ceramics and many metals.

More than 400 types of glass-ceramics have been made experimentally by Corning Glass Works. They can be formed by conventional glass - forming methods — blowing, drawing, pressing and rolling—and also by centrifugal and investment casting techniques.

Some types of Pyroceram possess a high ratio of strength to weight, having a specific gravity of 2.40 to 2.62, and a modulus of rupture (flexure strength) of 37,000 psi. There is little loss of strength at temperatures up to 1300° F. Deformation temperatures range up to 2460° F. Its hardness cannot be measured by Brinell or Rockwell. In comparative diamond indentation tests, it has been found harder than flint or hardened high-carbon steels (Rc 65) but not as hard as sapphire. It is extremely resistant to abrasion. It has a wide range of thermal properties with coefficients of expansion ranging from slightly negative to 200 $\times$ 10^{-7} °C. Thermal conductivity of some glass-ceramics is approximately three times higher than borosilicate glass, and it is highly resistant to thermal shock. Tests to date show the material can be made resistant to chemical attack.

Pyroceram glass-ceramics can be individually formulated to have good mechanical properties, excellent electrical resistance, high deformation temperatures, superior thermal shock resistance and high hardness.—**Reported by S. C. Smith for Southern Tier Chapter.**

Gives Details on Research in Europe

Shown at a Meeting of Canton-Massillon Chapter Are, From Left: G. P. Michalos, Treasurer; W. W. Scheel, Vice-Chairman; G. B. Trumble, Chairman; Edward Epremian, U. S. Atomic Energy Commission, Who Spoke on "Metallurgical Research in Europe"; and A. J. Gusky, Secretary of the Chapter

Speaker: E. Epremian

U. S. Atomic Energy Commission

Edward Epremian, chief, Metallurgy & Materials Branch, Division of Research, U. S. Atomic Energy Commission, presented a picture of "Metallurgical Research in Europe" before the **Canton-Massillon Chapter,** based largely on his experience with the London branch of the U. S. Office of Naval Research.

The talk described the nature of metallurgical research in a number of European countries, particularly England, Germany and France, with occasional comparisons with the United States. The factors underlying the status of metallurgical research in the various countries were discussed and attention was drawn to the more important laboratories and unique institutions with respect to their research programs, as well as the part they play in their country's metallurgical effort.

British contributions in theoretical regions and basic research have been very significant and, in at least two cases—alloy theory and the theory of dislocations, they have led the way. The work at the universities has been very important and mention was made of the research programs at Birmingham, Bristol, Cambridge, Oxford, Sheffield and the Imperial College of Science and Technology. In government, the Department of Scientific and Industrial Research, along with the member firms from industry, supports research associations for various fields, the largest of which is the British Iron and Steel Research Association, whose laboratories conduct a broad program of basic and applied research relevant to the steel industry. Metallurgical research for the military is handled by the Ministry of Supply and the Royal Naval Scientific Service, which have their own laboratories as well as support extra-mural research.

Research on materials for air is quite aggressive with work being conducted at the Royal Aircraft Establishment and the National Gas Turbine Establishment and various research contracts and grants on topics such as high-temperature alloys, titanium, cermets, etc. The Atomic Energy Research Establishment at Harwell has a fine program on the basic and applied metallurgical aspects of nuclear power reactors. British industry is quite research minded and the speaker described the scope of metallurgical work at several notable firms.

The remarkable regrowth of metallurgy in Germany and the strong condition of its metallurgical research today was attributed to: (1) extensive Marshall Aid; (2) strength of the academic institutions; (3) well-organized institutions such as the Max Planck Institutes; and (4) aggressive industry which invests a significant portion of its budget in research. After discussing each of these items, the speaker described research projects of interest at the various German laboratories.

The significant contributions of French academic, government and industrial laboratories were outlined but it was pointed out that metallurgy is not very well recognized as a field of science in the universities and that French industry, with a few important exceptions, is not willing to invest in research. The laboratories discussed included the Ecole des Mines, Conservatoire des Arts et Metiers, Institute for Steel Making Research (IRSID), National Laboratory for Aeronautical Research (ONERA), Ugine Co., and others.

Lack of time prevented discussion of the other countries and, in concluding his talk, Dr. Epremian emphasized the fact that European countries, by necessity, have formed cooperative research organizations, particularly for steel.—**Reported by G. L. Perkins for Canton-Massillon.**

Discusses Metallurgy in the Future

Shown at the Tenth Anniversary Night of the Founding of the Purdue Chapter Are the Past Chairmen Who Were Able to be Present. They are, from left: Lester Alban, Harold Bates, Alvin Hurst, Leonard Ewalt, present chairman, Carl Anderson, John T. McCormack of Reynolds Metals Co., Who Presented a Talk on "Metallurgy in the Future"; and T. F. McCormick

Speaker: J. T. McCormack
Reynolds Metals Co.

The speaker for the Tenth Anniversary Night meeting of the **Purdue Chapter** was John T. McCormack of Reynolds Metals Co., who spoke on "Metallurgy in the Future". The talk considered the future uses of metals, as indicated by present research activities.

One of the subjects brought forth was the use of aluminum in missiles. Aluminum powder can be used as a fuel component for the missiles, and there are also missile structural parts which double as rocket fuel.

The effect of nuclear radiation on metal atomic reactor parts was discussed, as well as the use of metals in reactors. One metal alloy used as shielding is an aluminum-boron carbide alloy; ¼-in. thicknesses of this alloy give the equivalent protection of 3 ft. of concrete.

Atomic reactors used as power plants for submarines, tankers and aircraft carriers were touched upon, and the tremendous range which is possible when these reactors are used was discussed.

Dr. McCormack also mentioned substantial strength increases in certain aluminum alloys after irradiation, the need for more extractive metallurgy courses in college curricula, vacuum melting and casting, and nondestructive testing methods.

Approximately 100 engineers and students attended the meeting.—**Reported by Terrance Lindemer for Purdue Chapter.**

A. S. M. has produced and makes available for showing before chapters and educational institutions moving picture films pertaining to metals.

Explains Materials Used In Jet Aircraft at Akron

Speaker: A. Shames
North American Aviation, Inc.

At a meeting held by the **Akron Chapter,** Alvin Shames of North American Aviation, Inc., presented an informative talk on "Structural Materials Used for Jet Aircraft". Mr. Shames first described the grimness with which the military aircraft industry is undertaking its job. The importance of the proper selection and usage of structural materials was stressed in relationship to its effect upon the final success of the weapon system.

The important mechanical and physical properties, as well as the advantages and disadvantages of three general types of material were discussed.

Mr. Shames touched upon the increased usage of the relatively new precipitation-hardening stainless steels such as 17-4 PH, 17-7 PH and AM 350, and described new uses for established materials. One example was the use of 4340 at a strength level up to 260,000 psi., another example was the use of hot work die steel (5% chromium type) to 300,000 psi. The extreme precautions necessary to avoid decarburization and hydrogen embrittlement of the latter steel were emphasized. In this connection, the speaker noted that recent work indicated that the reduction of area test used for determining the presence and degree of hydrogen embrittlement was not reliable. He further mentioned the success of North American in improving ductility at high strength levels by special heat treatment.

The increased usage and several new applications of titanium and titanium alloys were mentioned. Many of the older problems, such as nonuniformity, skin effect and tendency toward delayed failures, have been materially improved. New problems, however, have arisen. A recent example is the tendency of titanium to pit when severely formed.

In closing, Mr. Shames set forth the extreme precautions necessary to avoid errors in the selection and usage of materials because of the fearful consequences, especially loss of human life.—**Reported by Manuel Goldman for Akron.**

—Meeting Tomorrow With Metals Today—

Presents Thoughts on a New Alloy in Montreal

Speaker: P. R. Gendron
Ottawa University

At a meeting of the **Montreal Chapter,** Pierre R. Gendron, dean of the faculty of science at Ottawa University, gave a thought-provoking talk on the subject, "A Hard Alloy to Make: Education and Modern Technology". Dr. Gendron defined education primarily as the teaching of people to think, to shape a sound philosophy of life and to establish personal objectives or goals. In short, the purpose of education should be to provide knowledge and wisdom—information on causes, purposes, the "why" of things.

Technological training, on the other hand, is concerned with the means, effects, the "how" of things. Technology should teach us, through research and experiment, to promote the advancement of science and the harnessing and exploitation of basic scientific discoveries.

The knowledge and skills provided by both education and technology are necessary and often overlap. The real problem of the modern educator is to alloy the two in the right proportions. The trend of the age seems to confirm the technical and utilitarian interests of the modern university. The tendency is to drift away from the humanities towards scientific specialization and applied research, which are good and necessary things, but not all-sufficient.

Specialization leads students off in 1000 divergent directions. In the world of today it is all the more necessary to compensate for this dispersion by some studious interests pursued in common and by community of life. It should not be forgotten, contends Dr. Gendron, that universities have a part to play in cultivating and fostering creative thinking and as interpreters of the things of the spirit. — **Reported by D. F. McLeod for Montreal.**

Describes Use of Molten Salt Baths in Heat Treating

Speaker: E. N. Case

Ajax Electric Co.

The many applications and advantages of the use of "Molten Salt Baths in Heat Treating and Brazing" were described by E. N. Case, sales manager, Ajax Electric Co., at a meeting in **British Columbia.**

Among the advantages described were rapid heating, uniform temperatures, freedom from scale, automatic preheating, low distortion, brazing and cleaning of castings. In addition, longer life, reasonable maintenance of the equipment involved, and higher productive capacity can be obtained with a very low investment for each unit of production involved. —**Reported by Alex Ross for British Columbia Chapter.**

—Horizons Are Crossed on Bridges of Metal—

Speaks in Des Moines on Heat Treating Practices

Speaker: E. L. Kemper

A. F. Holden Co.

Members of the **Des Moines Chapter** heard a talk on the "General Practice of Heat Treatment" given by E. L. Kemper, manager, product development, A. F. Holden Co. Mr. Kemper supplemented his talk with slides depicting the types of equipment used in industries employing heat treating departments.

The problem faced today by heat treating departments in the metal industry is two-fold obsolescence and human error. Obsolescent practices must be eliminated since well-designed parts depend on the proper control of such variables as protective atmospheres, quenching and annealing. The still widely practiced use of potions and mysterious procedures is being and must be supplanted by heat treatment as a reliable science.

Automation in the heat treating department promises to eliminate the second problem, that of the element of human error. If industries employing heat treating departments are classified into three categories based on the size of the installation, the large industries, which includes the steel and auto manufacturers, are today the ones primarily employing automatic processing in their control of heating, annealing and quenching of metal parts. The size and quantity of parts treated in the large industries require the use of automation. The medium-size industry still relies, for the most part, on batch-type furnaces for the practical heat treatment of many parts; however, the medium-size industry also employs automatic processes where the size part and quantity require such equipment. Shaker-hearth and rotary retort-type furnaces are two types adapted to automation in this instance. The heat treatment installations in small industries cannot usually justify automation since the quantity of parts produced does not economically make this feasible. For this reason salt bath procedures are most widely used by tool and die heat treaters and hand tool manufacturers.

New developments in the heat treating of metals include the further trend to automation in many more of the processes involved and the development of such recent innovations as high-speed heating with the luminous wall furnace.—**Reported by Edwin D. Gibson for Des Moines.**

Reports on High-Strength Steels

John C. Hamaker, Jr., Vanadium-Alloys Steel Co., Spoke on "High-Strength Steels for Aircraft at Normal and Elevated Temperatures" at a Recent Meeting Held by San Fernando Valley Chapter. Shown are, from left: Dr. Hamaker, Dick Frohmberg, vice-chairman; and George Basl, the program chairman

Speaker: John C. Hamaker, Jr.

Vanadium-Alloys Steel Co.

Members of the **San Fernando Valley Chapter** heard John C. Hamaker, Jr., manager of research, Vanadium-Alloys Steel Co., talk on "High-Strength Steels for Aircraft at Normal and Elevated Temperatures".

First, he gave a review of high-strength structural steels, stating that most of the older steels, being hardened by an oil quench and tempered at a low temperature tended to give poor service life due either to "locked-in" residual stresses, or to retained austenite which converted to brittle martensite after shock loading. He brought out how these steels were improved, to some degree, by the additions of silicon, boron and titanium, in an attempt to meet the aircraft industry's demands for higher strength steels with greater toughness. The advent of supersonic aircraft imposed an additional requirement or demand for structural steels useful at elevated temperature.

Dr. Hamaker continued by discussing how various toolsteel compositions were studied for the purpose of developing an alloy useful for structural purposes. It was known that high-speed toolsteels could be hardened to 400,000 psi. yield, but the ductilities were all too low. Ultimately, one of the popular hot work die steels (H-11) was modified to yield an excellent high-strength structural steel, good up to 1000° F., and given the trade name Vascojet 1000. Research has shown Vascojet 1000 to contain the lowest alloy analysis that will impart true secondary hardening, so essential to complete stress relief for maximum toughness and to strength retention at elevated temperature. A nominal composition of 0.40% C, 5.00% Cr, 1.30% Mo and 0.50% vanadium was given for the alloy. Further alloy additions appear to do little to improve strength, and they decrease toughness and fabricability, and increase the cost. Numerous slides were shown comparing the room and elevated temperature properties of Vascojet 1000 with other alloys. The values at 400-1000° F. appeared to place the alloy in a class by itself, surpassing present titanium alloys and hardenable stainless steels. It was shown to be a deep, air hardening steel, exhibiting tensile strengths of 265,000-290,000 psi. when tempered at 1000-1050° F., and a yield of 225,000-235,000 psi., with 7.8 to 8.5% elongation, and an impact value of 15 ft-lb. at 100° F. It can be welded or forged readily; machined with ease in the annealed condition (180-210 Brinell), and frequently in the hardened condition; deep drawn, in the annealed condition; and aluminized or nitrided for surface protection or wear resistance. Transverse strength and ductility meet tentative A.I.A. requirements in sections up to 16 x 16 in.

The talk was concluded with a discussion of possible future alloys being developed for high-strength structural use at temperatures up to 1350° F.—**Reported by E. L. Reed for San Fernando Valley.**

Describes Desulphurization Process

S. L. Gertsman, Department of Mines & Technical Surveys, Canada, Presented a Talk on the "Desulphurization of Iron and Steel" at a Meeting Held Recently by the Ontario Chapter. Shown are, from left: R. Smallman-Tow, chairman; Mr. Gertsman; and B. Hamilton, council member

Speaker: S. L. Gertsman
Department of Mines & Technical Surveys

Members of the **Ontario Chapter** heard S. L. Gertsman outlining the developments that have taken place in the field of "Desulphurization of Iron and Steel", which he introduced by recalling some of the reasons why this operation is necessary.

For gray iron it enables a more efficient use of scrap, correction of the ill effects of improper Mn-S ratio, savings in manganese and the necessity of meeting specifications. In nodular iron there are savings in the nodularizing agent. In wrought steels sulphur reduction improves transverse ductility, prevents hot shortness and reduces conditioning costs. In steel castings grain boundary sulphide troubles can be lessened and the hot tearing reduced. Low-temperature impact properties are considerably improved.

Furthermore, the importance of the development of sulphur control in Canada, for acid electric furnaces, owing to the cheaper refractories, smaller slag volumes and generally better economics of acid steels, which are frequently offset by failure to meet sulphur requirements, was stressed.

Mr. Gertsman demonstrated that carbon and silicon increase the activity of sulphur, hence iron is easier to desulphurize than steel. The sulphur is more loosely held. At 0.25% carbon and 0.50% silicon the activity is very low so that although cupola metal has long been ladle desulphurized, methods for steel are of relatively recent development.

Intimate contact is needed between the metal and the desulphurizing agent. Improvement in electric furnace desulphurization can be obtained by induction stirring. Kalling's procedure of rotating molten iron with lime and coke in a mixer provides good contact between the reacting substances.

The method of introducing the desulphurization reagent is important. A program was established to determine the relative efficiency of the desulphurizing agents used for iron. These reagents were lime, calcium, cyanamide, calcium-carbide, soda ash and sodium hydroxide.

The next tests were aimed at desulphurizing steel with magnesium alloys, part of this work being the development of methods to desulphurize acid steels. Initial tests were made by adding magnesium and alloys directly and by plunging.

A quiet method of addition was achieved by feeding magnesium wire through a steel pipe into the melt through a lime cover. This was followed by the use, in the ladle, of granulated magnesium or magnesium alloys mixed with a lime slag onto which the steel was poured. Blank tests on the lime were subtracted from the total effect and it was substantiated that effective desulphurization of basic steels could be obtained.

Trials with acid steels showed that this was quite a different proposition, and that the most intimate metal to reagent contact would be essential if any consistent results were to be achieved.

Injection of the additive was therefore tried, using argon as a carrier and employing 50-50 aluminum-magnesium alloy, first on basic steel with which up to 70% sulphur elimination was achieved. Duplicating these conditions with acid steel gave the encouraging result of 45% efficiency. With an improved design of lance, reductions in sulphur content by 10 to 20 points from 0.055% sulphur were obtained on ladle treating some 29 heats. Lancing directly into the acid electric furnace gave 6 to 10 points drop whether done before or after the boil. The use of a lance for injection into a basic electric furnace reduced the sulphur from 0.030 to as low as 0.006 and this is felt to be a sound economic practice and should be of interest to the heavy forging producers. The furnace operation is smoother than ladle treatment and the few mechanical troubles may readily be overcome.

A summary of 85 heats of acid and basic steels indicates that reductions of up to 40% of the steel's original sulphur can be obtained by lancing basic induction and acid electric steel in the ladle. The operation takes approximately 2 min. for a 500 lb. heat, but is accompanied by considerable temperature loss (100° F.). Similar treatment in the acid electric furnace gave an average reduction of about 8 points sulphur from 0.055%. Some further work is required to develop a successful and consistent method of desulphurizing acid steels, but as Mr. Gertsman pointed out, the results are hopeful and the work is continuing.—**Reported by H. G. Warrington for Ontario.**

**—ASM Has a Place in the Future
The Future Has a Place in ASM—**

Speaks on Steelmaking at Jacksonville Meeting

Speaker: B. W. Boisvert
U. S. Naval Air Station

At a meeting held recently by the **Jacksonville Chapter,** Bernard W. Boisvert, metallurgist, Overhaul and Repair Department, U. S. Naval Air Station, and chairman of the Chapter, discussed the "Principal Phases of the Production of Steel". His talk covered these principles through raw materials and blast furnace smelting, and was followed by a movie produced by the Bethlehem Steel Co. entitled Highlights in Steelmaking. The film illustrated the pouring of ingots, rolling the ingots in the blooming mills, plus final processing of the intermediate products made in the blooming, slabbing and billet mills, rolling on continuous rod mills and strip-sheet mills.

The important steps in heat treatment—quenching, tempering, normalizing and annealing—were illustrated by scenes from the plant. After the film a question and answer discussion was held by the speaker.—**Reported by Anthony Breda for Jacksonville Chapter.**

CHAPTER MEETING CALENDAR

Akron	**Feb. 19**	Sanginiti's		Welding
Albuquerque	**Feb. 25**	La Placita	**E. C. W. Perryman**	Nuclear Power Production and Irradiation Damage
Boston	**Feb. 7**	M.I.T. Faculty Club		National Officers Night
Calumet	**Feb. 11**	Phil Smidt	**K. Van Kirk**	Nondestructive Testing—Steel
Canton-Massillon	**Feb. 4**	Mergis Restaurant	**G. M. Young**	Extrusion Process
Carolinas	**Feb. 27**	Salisbury	**J. F. Victory**	Aviation and a Look at the Future
Cedar Rapids	**Feb. 11**	Roosevelt Hotel	**T. B. Jefferson**	What's New in Welding
Chicago	**Feb. 10**	Furniture Club	**G. Roberts**	
Chicago-Western	**Feb. 17**	Old Spinning Wheel	**H. B. Osborn, Jr.**	Induction Heating
Cincinnati	**Feb. 13**	Engineering Society	**J. H. Frye, Jr.**	Materials—Bottleneck to Commercial Power
Cleveland	**Feb. 3**	Hotel Manger	**R. Easton**	Continuous Casting
Columbus	**Feb. 5**	Broad St. Church	**J. C. Hamaker, Jr.**	High-Strength Steels for Aircraft
Dayton	**Feb. 12**		**J. C. Free**	Manufacture of Jewelry—Ladies Night
Delaware Valley	**Feb. 19**		**Social**	Ladies Night—Valentine Party
Detroit	**Feb. 10**		**G. M. Young**	Aluminum Alloy Development
East. New York	**Feb. 11**	Panetta's		Metallurgical Education
Golden Gate	**Feb. 3**	Spenger's Grotto	**J. H. Hollomon**	New Advances in Metallurgy
Hartford	**Feb. 11**	Indian Hill Cty. Club	**Panel**	Surface Hardening
Indianapolis	**Feb. 17**	Village Inn	**H. R. Sparks**	Welding Metallurgy of Carbon Steel
Kansas City	**Feb. 19**	Golden Ox Restaurant	**Panel**	
Los Angeles	**Feb. 27**	Rodger Young Audit.	**Panel**	Cold Forming Metals by Extraordinary Methods
Louisville	**Feb. 4**	White Cottage	**L. S. Busch**	Titanium
Mahoning Valley	**Feb. 15**	V.F.W. Building	**Social**	Valentine Dinner-Dance
Milwaukee	**Feb. 18**	City Club	**W. T. Rogers**	Metallurgical Quality Control
Minnesota	**Feb. 26**	Calhoun Beach Hotel	**D. R. Edgerton**	What's New in Heat Treating
Montreal	**Feb. 3**	Queen's Hotel	**F. Smythe**	Development in Aircraft by Canadian Industry
New Haven	**Feb. 20**	Waverly Inn	**W. H. Steurer**	Guided Missiles
New Jersey	**Feb. 17**	Essex House	**P. D. Frost**	Titanium Today
New Orleans	**Feb. 5**	Lenfant's	**G. Allen**	Welding of Aluminum
New York	**Feb. 3**	Brass Rail		Guided Missiles; Material Requirements
North Texas	**Feb. 6**		**L. W. Kalinowski**	Hot Oil Marquenching of Aircraft Steels
NE Pennsylvania	**Feb. 13**	Irem Temple Cty. Club	**S. G. Fletcher**	Selection and Heat Treatment of Tool and Die Steels
Notre Dame	**Feb. 12**	Nabicht Bros.	**P. Payson**	Ultra High-Strength Steels
Oak Ridge	**Feb. 19**	K of C Hall		National Officers Night
Old South	**Feb. 4**	Greenville, S. C.		Prestressed Concrete
Ontario	**Feb. 7**	Prince George Hotel	**G. M. Young**	President's Night
Penn State	**Feb. 11**	M.S.A.	**M. Brezin and W. Crafts**	What Industry Expects of a College Graduate
Peoria	**Feb. 10**	American Legion	**O. E. Cullen**	Quenching Practices
Philadelphia	**Feb. 28**	Engineers Club	**F. O. Hess**	Continuous Furnace Design
Philadelphia Jr.'s	**Feb. 10**		**Social**	Ladies Night
Pittsburgh	**Feb. 13**	Gateway Plaza	**E. C. Bain**	Andrew Carnegie Night
Quebec	**Feb. 18**	Laval University	**A. O. Dufresne**	Mining and Development in Quebec
Rhode Island	**Feb. 5**	Johnson's Hummocks Grill	**R. Newhall**	Chemical Evaluation in Metals
Rochester	**Feb. 10**	Howard Johnson's	**H. R. Clauser**	Engineering Materials
Rockford	**Feb. 26**	Faust Hotel	**R. Wagner**	Cold Heading—Principles and Practices
Rome	**Feb. 3**	Trinkus Manor	**A. E. Howe**	Advances in Electroplating
St. Louis	**Feb. 21**	Congress Hotel	**M. De Hollander**	Engineering Castings
Springfield	**Feb. 17**	Blake's Restaurant	**J. R. Boehm**	Small Precision Tools
Texas	**Feb. 4**	Ben Milam Hotel	**M. Cohen**	Hardening of Steel
Warren	**Feb. 13**	Astoria Cafe	**R. C. Clark**	Communication in Industry
Washington	**Feb. 10**	Arlington Towers	**M. Cohen**	Phase Transformations
West Michigan	**Feb. 15**	Schnitzelbank	**Social**	Ladies Night
Wichita	**Feb. 11**	K of C Hall	**E. L. Kemper**	Salt Bath Descaling and Fluxing
Wilmington	**Feb. 12**	Powder Mill	**J. Althouse**	Cladding of Metals
Worcester	**Feb. 12**	Hickory House	**T. Sendzimir**	New Rolling Process—Sendzimir Mill
York	**Feb. 12**	York	**W. S. Cummings**	Iron Ores

Appointments to A.S.M. Standing Committees

At the meeting of the Board of Trustees of the American Society for Metals held Sept. 5-6, appointments to various national committees of the Society were announced by President-Elect Young and confirmed by the Board. The complete personnel of the standing committees is listed below. The new appointments are shown in italics and the numerals represent the date of expiration of the appointment. Chapter affiliations are listed rather than employment addresses.

Metal Progress Advisory Committee

G. M. Young, Aluminum Co. of Canada, Ltd., Montreal, '58.
John W. Sweet, Boeing Airplane Co., Puget Sound, '58.
E. H. Snyder, Austin Western Division, Baldwin-Lima-Hamilton Corp., Chicago-Western, '59.
W. A. Stadtler, International Business Machines Corp., New York, '59.
M. H. Brown, E. I. du Pont de Nemours & Co., Philadelphia, '59.
John J. Chyle, A. O. Smith Corp., Milwaukee, '60.
Frank G. Foote, Argonne National Laboratory, Chicago, '60.
Harry W. McQuaid, Consultant, Cleveland, '60.
Clarence Lorig, Battelle Memorial Institute, Columbus, Representative of the Board of Trustees.

Constitution and By-Laws Committee

Kenneth MacKenzie, International Business Machines Corp., Southern Tier, '58, Chairman.
M. E. Huether, Revere Copper & Brass Inc., St. Louis, '58, Past Chairman.
William F. Eberly, Vanadium-Alloys Steel Co., Philadelphia, '58.
P. K. Raiford, Kaiser Aluminum & Chemical Corp., New Orleans, '59.
M. V. Walberg, Viking Forge & Steel Co., Golden Gate, '59.
Miller LaBau, Cincinnati Milling Machine Co., Cincinnati, '60.
Richard Smallman-Tew, Avro Aircraft Ltd., Ontario, '60.
E. E. Stansbury, University of Tennessee, Oak Ridge, Representative of the Board of Trustees.

Finance Committee

Zay Jeffries, General Electric Co., Cleveland, Honorary Chairman.
Robert Aborn, U. S. Steel Corp., Pittsburgh, Chairman.
K. R. Van Horn, Aluminum Co. of America, Pittsburgh, '58.
A. A. Hess, American Society for Metals, Cleveland, '59.
J. P. Fowler, Texas Steel Co., North Texas, '59.
W. F. Nash, Jr., C. F. Braun & Co., Los Angeles, '59.
Floyd Olmsted, Lee Wilson Engineering Co., Inc., Cleveland, '60.
John F. Thompson, International Nickel Co. of Canada, Ltd., New York, '60.
L. Hamaker, Republic Steel Corp., Canton-Massillon, '60.

Transactions Committee

J. F. Libsch, Lehigh University, Lehigh Valley, '58, Chairman.
R. D. Chapman, Chrysler Corp., Detroit, '58, Past Chairman.
George Enzian, Jones & Laughlin Steel Corp., Pittsburgh, '58.
H. Y. Hunsicker, Aluminum Co. of America, Cleveland, '58.
William A. Reich, General Electric Co., Detroit, '58.
Daniel J. Girardi, Timken Roller Bearing Co., Canton-Massillon, '58.
Paul G. Nelson, The Budd Co., Philadelphia, '58.
John Dorn, University of California, Golden Gate, '59.
R. W. Guard, General Electric Co., Eastern New York, '59.
J. H. Bechtold, Westinghouse Electric Corp., Pittsburgh, '59.
E. M. Mahla, E. I. du Pont de Nemours & Co., Philadelphia, '59.
Morris Cohen, Massachusetts Institute of Technology, Boston, '59.
W. C. Winegard, University of Toronto, Ontario, '60.
E. P. Holtberg, Olin Mathieson Chemical Corp., New Haven, '60.
O. O. Miller, International Nickel Co., Inc., New Jersey, '60.
E. C. Miller, Oak Ridge National Laboratory, Oak Ridge, '60.
W. R. Opie, New Jersey, '60.

Handbook Committee

N. E. Promisel, Bureau of Aeronautics, Washington, '58, Chairman.
G. F. Kappelt, Bell Aircraft Corp., Buffalo, '58.
J. J. Repko, National Advisory Committee for Aeronautics, Cleveland, '58.
M. L. Frey, Allis-Chalmers Manufacturing Co., Milwaukee, '58.
T. A. Frischman, Eaton Manufacturing Co., Cleveland, '58.
R. W. Leiter, The Budd Co., Philadelphia, '58.
S. R. Prance, Inland Manufacturing Division, Dayton, '58.
N. J. Grant, Massachusetts Institute of Technology, Boston, '59.
Leo Schapiro, Douglas Aircraft Co., Los Angeles, '59.
G. P. Phillips, International Harvester Co., Chicago, '59.
W. A. Dean, Pittsburgh, '60.
W. D. Gilder, Reed Roller Bit Co., Texas, '60.
M. J. Day, Crucible Steel Co. of America, Chicago, '60.
F. Rote, Albion Malleable Iron Co., West Michigan, '60.

Advisory Committee on Metallurgical Education

Robert Sweet, Michigan State College, West Michigan, '58, Chairman.
R. F. Hehemann, Case Institute of Technology Cleveland, '58, Past Chairman.
Kenneth E. Rose, University of Kansas, Kansas City, '58.
A. W. Grosvenor, Drexel Institute of Technology, Philadelphia, '58.
H. W. Paxton, Carnegie Intsitute of Technology, Pittsburgh, '59.
H. H. Bliss, University of Oklahoma, Tulsa, '59.
R. M. Parke, General Electric Co., Eastern New York, '59.
Fred Kisslinger, Illinois Institute of Technology, Chicago-Western, '60.
William Charlesworth, Perfect Circle Corp., Muncie, '60.
Earl Roberts, University of Washington, Puget Sound, '60.
G. A. Fisher, Jr., International Nickel Co., Inc., St. Louis, Representative of the Board of Trustees.

Seminar Committee

Bruce Chalmers, Harvard University, Boston, '58, Chairman.
W. R. Hibbard, Jr., General Electric Co., Eastern New York, '58, Vice-Chairman.
R. Maddin, University of Pennsylvania, Philadelphia, '58, Past Chairman.
M. B. Bever, Massachusetts Institute of Technology, Boston, '58.
Pol Duwez, California Institute of Technology, Los Angeles, '58.
J. S. Koehler, University of Illinois, Peoria, '58.
J. Harwood, Office of Naval Research, Navy Department, Washington, '59.
W. D. Robertson, Yale University, New Haven, '59.
R. L. Smith, Franklin Institute, Philadelphia, '59.
F. L. Vogel, Philadelphia, '59.
G. B. Craig, Ontario, '60.
J. Dorn, University of California, Golden Gate, '60.
R. I. Jaffee, Battelle Memorial Institute, Columbus, '60.
M. Nicholson, University of Minnesota, Minnesota, '60.

Metals Engineering Program Committee

George A. Roberts, Vanadium-Alloys Steel Co., Pittsburgh, '58, Chairman.

Appointments to A.S.M. Standing Committees

Paul Nelson, The Budd Co., Philadelphia, '58.
James C. Hodge, Warner & Swasey Co., Cleveland, '58.
E. C. Blocks, Ecko Products Co., Chicago, '59.
Albert Mead, Grumman Aircraft, Long Island, '59.
Fred Arnold, Norris-Thermador Corp., Los Angeles, '60.
R. C. Dalzell, Washington, '60.
R. T. Bayless, T. Lyman and E. E. Thum, American Society for Metals, Cleveland.

Metallurgical Documentation Committee

Frank T. Sisco, Engineering Foundation, New York, Chairman.
Wallace R. Brode, Bureau of Standards, Washington.
D. G. Ebeling, General Electric Co., Eastern New York.
D. C. Hilty, Electro Metallurgical Co., Buffalo.
Herman Henkle, Crerar Library, Chicago.
I. H. Jenks, Aluminum Laboratories, Inc., Ontario.
G. A. Roberts, Vanadium-Alloys Steel Co., Pittsburgh.
A. J. Shaler, Pennsylvania State University, Penn State.
J. W. W. Sullivan, American Iron and Steel Institute, New York.
E. E. Thum, *Metal Progress,* American Society for Metals, Cleveland, Ex Officio.
Marjorie Hyslop, *Metal Progress,* American Society for Metals, Cleveland, Secretary.
(*All terms, this Committee, are for three years*)

IMPORTANT MEETINGS

for February

Feb. 3-7—American Institute of Electrical Engineers: Winter General Meeting, Hotel Statler and Sheraton-McAlpin, New York. (H. H. Henline, Secretary A.I.E.E., 33 W. 39th St., New York 18)

Feb. 4-6—Reinforced Plastics Division, Society of the Plastics Industry, Inc.: Annual Technical and Management Conference, Edgewater Beach Hotel, Chicago. (James R. Davidson, Executive Secretary, S.P.I., 34 E. Putnam Ave., Greenwich, Conn.)

Feb. 16-20 — American Institute of Mining, Metallurgical, and Petroleum Engineers: National Convention, Hotel Statler, New York. (Ernest Kirkendall, Secretary, 29 W. 39th St., New York 18)

WILBUR L. KENNICOTT, head of engineering activities, has been elected vice-president of Kennametal, Inc.

The National Forge & Ordnance Co., Irvine, Pa., announces that JOHN C. HARRINGTON, former president of the company, has been named chairman of the board of directors. ROBERT O. WILDER, formerly executive vice-president, has assumed the duties of president, and DUANE E. WILDER, secretary-treasurer, takes on the additional duties of vice-president.

LYMAN R. FINK is now general manager of the X-Ray Department, General Electric Co., Milwaukee, succeeding JOHN H. SMITH who resigned to accept a post on the faculty of the University of Wisconsin School of Business Administration.

RAYMOND H. FILSINGER, JR., who has been assistant vice-president, is now vice-president in charge of sales for Vanadium Corp. of America.

HERMAN A. ELY, JR., who has had extensive experience in the chemical cleaner field, is now manager of cleaner sales for Hanson-Van Winkle-Munning Co.

WILLIAM C. DENNISON, a pioneer in the development of hydraulic power for industry, was elected vice-president of the American Brake Shoe Co., and appointed to the operations policy committee.

STANLEY MARWIN is now assistant works manager of the Los Angeles plant of the American Manganese Steel Division of American Brake Shoe Co.

Crucible Steel Co. has announced the appointment of J. D. DICKERSON to the newly-created position of manager-steel production, to be responsible for operations at the Midland Works, Sanderson-Holcomb Works, Spaulding Works and Park Works, with headquarters in Pittsburgh.

Heavy Minerals Co. elected JOHN M. FRAME as executive vice-president to succeed E. E. WYATT who is executive assistant to the president of Crane Co. NEELE E. STERNS, president of Crane Co., was elected chairman of the board of Heavy Minerals, J. CARLTON WARD, JR., was re-elected president. W. W. STEPHEN, formerly assistant treasurer, was elected treasurer.

JOHN D. KLEIS has been appointed vice-president and director of research of Fansteel Metallurgical Corp., succeeding LEONARD F. YNTEMA who is retiring. Dr. Kleis will continue as manager of Fansteel's electrical contact division. ARTHUR B. MICHAEL will serve as administrative assistant to Dr. Kleis and as assistant director of metallurgical research.

ROGER J. BROWNE, major general, U.S.A.F., recently retired, has been appointed director of defense products by American Brake Shoe Co.

Additions to the research staff have been announced by Foote Mineral Co. DAVID W. MITCHELL is now manager of minerals research at the company's Kings Mountain laboratories, JUSTO B. BRAVO and MEYER M. MARKOWITZ have joined the Chemical Research Division as senior research chemist and project leader, and THOMAS E. CURRIE, senior ceramist, will specialize in porcelain enamel research.

K. A. LANG, manager of the Lindberg-Fisher Melting Division for the past ten years, is now manager of the Lindberg Engineering Co.'s plant in Downey, Calif., and is also responsible for the sales activities of the offices which cover the 11 western states.

—100 Years of Making Metal Work for Mankind—

Schedule Inspection Course

A ten-week course in "Radiographic Inspection" will be presented in the San Francisco Bay area starting Jan. 22. Lectures will be held each Wednesday between 7:30 and 9:45 p.m. The course is being co-sponsored by the Golden Gate and Santa Clara Valley Chapters A.S.M., Northern California Section of the Society for Nondestructive Testing and the X-Ray Department of the General Electric Co.

Topics to be covered include X-ray physics, X-ray circuits, radioisotopes, geometry of recording X-ray images, film characteristics and processing, fluoroscopy, Xeroradiography, image intensification, automatic inspection, establishing an X-ray inspection program and radiation safety.

Fee for the course will be $10 for nonmembers of sponsoring societies and $5 for members. Applications should be sent to: J. H. Anderson, Engineering Department, San Jose State College, San Jose 14, Calif.

A.S.M. spends $44.50 to service each member of the Society for a period of one year.

Describes Embrittlement Of Metals at Birmingham

Speaker: Bernard R. Queneau
Tennessee Coal and Iron Co.

Bernard R. Queneau, assistant manager, department of metallurgy, inspection and research, Tennessee Coal and Iron Co., spoke on the "Embrittlement of Metals" at a meeting held by the **Birmingham Chapter.**

Service failures of metal parts are more frequent than necessary in view of our present knowledge of the properties of metals and mechanical design. Fatigue is the most common cause of mechanical failure of metals in service, and most of these failures can be avoided by designing to eliminate points of high stress concentrations.

Brittle fracture is the second most frequent cause of metal failures. Large structures, such as ships and storage tanks, are also subject to this type of failure and the results are often catastrophic. Curves showing the mechanical behavior of metals under different loading conditions were used by Dr. Queneau to explain the brittle behavior of normally ductile steel plates.

In tension, the initial plastic deformation occurs uniformly along the gage length, then localized deformation occurs; this is commonly called necking. With an increase in strain, a fracture originates at the center of the neck and extends at right angles to the tensile stress. Final failure at the test piece is by shear.

Although the standard tensile test is not sensitive to changes in temperature, it is possible to cause a mild steel specimen to fail with a brittle fracture at temperatures below —300° F. The failure at this low temperature shows little plastic deformation, and fracture occurs through the grains.

A notch in a tensile sample introduces transverse stresses on loading and these triaxial stresses markedly decrease the ductility of the metal. By introducing various-shaped notches into a tensile specimen, the elongation was reduced. Without a notch, the elongation was 37%; a 9° taper reduced the elongation to 7%, a saw cut reduced the elongation to only 3%.

The severity of the test conditions can be further increased by increasing the rate of loading. With slow bending, failure occurred at — 100° F., whereas, with impact loading, failure occurred with equal breaking energy at 32° F. Standard impact tests have low rates of loading as compared with ballistic tests, and the usefulness of the impact test in studying the resistance of a metal to brittle failure depends primarily upon the presence of a notch in the test specimen.

A double-width sample with twice the normal cross-sectional area fails in a brittle manner at higher temperature because of additional restraint introduced with larger cross sections.

Mechanical properties of metals may change with time or temperature to such an extent as to be the cause of a brittle failure. This embrittlement is usually the result of the precipitation of a phase from solid solution, and is especially damaging when it occurs at grain boundaries.

In general, aluminum-killed steels show a lower transition temperature than semi-killed steels or rimmed steels. The effect of the aluminum is twofold—first, in refining the grain size of the steel; and second, in combining with both oxygen and nitrogen present in small amounts in all steels.

In the low-carbon steels, strain aging results in an increase in strength and hardness coupled with a decrease in ductility after any cold working operation such as bending, shaping or deep drawing.

Strain aging can occur at room temperature and is of major commercial importance because of its effect on the yield point. The yield point must be eliminated or suppressed in mild steels to prevent localized yielding which forms Luder's lines or stretcher strains resulting in poor surface appearance. The yield point can be eliminated by cold working such as "skin rolling"; however, this treatment is not permanent and the yield point returns because of strain aging.

Non-aging steels have been deoxidized with aluminum, and any nitrogen present is precipitated in the form of stable aluminum nitrides. These steels are much less embrittled by cold working operations and the yield point does not return rapidly as in the case of rimmed steels.

Quench aging is primarily the result of carbide precipitation and can occur in any steel. Quench aging develops more slowly than strain aging and overaging or softening occurs rapidly at temperatures above 150° F.

Temper brittleness has been associated with the loss in toughness which occurs on tempering steels at 1000° F. This embrittlement is also associated with a carbide precipitation which causes the steel to be notch sensitive and to fail in a brittle manner under severe conditions of loading.—**Reported by Robert E. Fisher for Birmingham.**

—Metallurgy Is the Stepping Stone to Advancement—

Talks on Induction Heating at Jackson

Speaker: H. B. Osborn
Ohio Crankshaft Co.

H. B. Osborn, Ohio Crankshaft Co., gave a talk on "Induction Heating" at a meeting held recently by the **Jackson Chapter.**

Dr. Osborn recalled the early days when Dr. Northrup was trying to interest people in the subject of induction heating. As far back as 1932, Dr. Northrup had successfully demonstrated surface heating by the electrical induction method. To illustrate the great strides that induction heating has made, Dr. Osborn explained that in 1939, the equipment built by his company for induction heating amounted to $250,000, 100% of which was used for surface hardening . The figures for a similar period recently ran up to $13,000,000, of which but 10% was used for surface hardening.

The demand for higher frequencies has been brought about by the wide variety of applications for induction heating. In the 1930's, the standard high-frequency alternating generator was built for 1920 cycles. It took much effort for many years to obtain sufficient interest by the large electrical companies for the development of higher frequency generators. At the present time, mechanically driven alternating current generators up to 30,000 cycles are available. In addition, vacuum tube oscillators go up to 450,000 cycles and higher.

In general, MG sets are made in sizes from 7½ to 350 kw. and in the ranges of 2000, 3000, 10,000, 20,000 and 30,000 cycles. For larger power requirements, Dr. Osborn said that identical MG sets can be readily connected in parallel. The cost of 30 kw. MG sets has been brought down to as low as $100 per kw.

Dr. Osborn explained many instances where the heat treating of 1045 and 1050 steels by the induction method can be used to replace the highly critical and expensive nickel alloy steels.

Slides were then shown which illustrated many of the induction heating machines manufactured by Ohio Crankshaft. The illustrations showed that the induction heating machine is actually a precisely constructed machine tool. For example, one such machine shown was capable of producing automatically 600 camshafts per hr.

Other applications mentioned by the speaker included the surface hardening of rear axle housings to provide additional strength, vacuum melting, etc. The use of induction surface hardening can produce in a 1045 steel a hardness of Rockwell 60-C. Most of the steels used are in the 1040-1050 class, although sometimes series 1100 steels are used because of their easier machining.—**Reported by Willard Stewart and Lew Smith for the Jackson Chapter.**

Gives Ideas on Problem Solving and Creative Thinking in Chicago

Speaker: H. R. Clauser
Materials in Design Engineering.

H. R. Clauser, editor of *Materials in Design Engineering,* presented a talk entitled "Problem Solving and Creative Thinking" at a meeting of the **Chicago Chapter.**

The thinking we do in performing our jobs and in making decisions is largely concerned with solving problems. The systematic, rational approach to problem solving, as opposed to the ordinary unsystematic approach, is often referred to as the scientific method. More accurately, it is the application of the scientific attitude to the solving of problems.

Perhaps the principal distinguishing characteristic of the scientific attitude is the reliance on objective facts and the rejection of authority and opinion as the basis for truth. The scientific attitude is also identified with a mental or intellectual approach that includes the following characteristics: an inquiring mind; an open mind; a critical mind; a passion for accuracy; and intellectual honesty.

Stated briefly, the scientific method of problem solving involves recognizing and defining the problem, gathering facts pertinent to the problem, formulating tentative solutions (hypotheses), evaluating tentative solutions and drawing conclusions or deciding on solution.

Indispensable to problem solving are the tools of thinking. They enable us to check the validity and the consistency of our facts, to find relations between facts, to arrive at correct conclusions, and to derive formulas or laws that can be used to solve other problems.

Some of these tools, such as traditional logic and mathematics, are centuries old. Others, such as probability mathematics, symbolic logic, operational research and the theory of games, are relatively recent developments.

In formulating the tentative solutions there are two approaches to the problem. There is the classical or formal approach and the creative thinking approach.

The classical or formal approach is the older approach of using the classical methods of science to analyze the problem and through using these tools arrive at a solution.

The second approach is through the use of creative thinking. Today the term creative thinking is generally used to refer to techniques of producing new ideas. These ideas are tentative, not final, solutions to a problem and must undergo evaluation. There are three groups or types of creative thinking techniques.

The first is free association, a free-wheeling, uninhibited approach with the object of producing many ideas of all kinds. Most of the techniques in this category rely chiefly on conference method to stimulate ideas by association. Included in this technique are brainstorming and the Gordon method.

The second or analytical approach is a more systematic approach involving the questioning of the elements of the problem to freely generate ideas. These include checklists, attribute testing where all the qualities of a problem are listed and the input-output approach.

The third approach is the forced relationship technique where unusual or unnatural relationships between ideas are forced as a starting point for a series of free associations that will lead to a new idea. The ideas or solutions developed in these methods must be evaluated (by experimental or factual verifications).

At the close of the discussion period a brainstorming session was held with Mr. Clauser acting as moderator. A panel was selected from the audience with the topic for discussion "How to improve attendance at the chapter meetings". In all, about 20 suggestions were developed, some of which were considered very good and will be further studied.—**Reported by A. J. Laudenklos for Chicago Chapter.**

Explains High-Speed Aircraft Steels

"Present-Day Steels Designed for Use in Ultra High-Speed Aircraft" Was the Title of a Talk in Los Angeles by A. P. Terrile (Right), Crucible Steel Co. of America. He is shown with John Rizley, technical chairman

—Service Through Metals Serving for Finer Metals—

Speaker: A. P. Terrile
Crucible Steel Co. of America

Alan P. Terrile, staff metallurgist of the Crucible Steel Co. of America, addressed a recent meeting of the **Los Angeles Chapter** on the subject "Present-Day Steels Designed for Use in Ultra High-Speed Aircraft".

Mr. Terrile first stated some of the target requirements of the rocket and missile field, such as 200,000 psi. ultimate strength at 1000° F. Using appropriate graphs, he demonstrated how these targets can be met through the use of existing tool and die steels. The 5% Cr, 1% Mo, 0.3% V hot work steels can be produced in sheet and plate suitable for airborne applications and they show good stability of physical properties over long exposure to high temperatures.

The many aircraft and rocketry engineers in the audience were assured by Mr. Terrile that the steel companies would develop these steels in accordance with the economic demands of the aircraft and missile industries.—**Reported by C. H. Dickson for Los Angeles.**

As an indication of the tremendous dissemination of engineering information, a compilation shows that in one year the A.S.M. collected, edited, published and distributed over *one hundred million pages* of metallurgical information.

Meet Your Chapter Chairman

OTTAWA CHAPTER

ROBERT L. CUNNINGHAM, principal scientist, Physical Metallurgy Division, Mines Branch, Department of Mines and Technical Surveys, graduated from Dalhousie University in his native Nova Scotia before moving to McGill and obtaining his Ph.D. Bob has a substantial background as a physical metallurgist and as head of the Metal Physics Section at the Mines Branch prior to the present appointment.

A family man, he has five children, two sons and three daughters, ranging in age from 4 to 14 years.

He is a member of the Canadian Institute of Mining and Metallurgy, the Institute of Metals and the American Crystallographic Association. He recently served as a member of the local committee for the 4th International Congress and Symposia of the International Union of Crystallography in Montreal.

Dr. Cunningham has previously served as councilor and vice chairman of the Ottawa Valley Chapter, as well as in the capacity of chairman of various committees. At the national level, he has served the past three years on the National Seminar Committee.

His hobbies and interests include woodworking, ham radio, mineral collecting and curling.

EASTERN NEW YORK

ARTHUR A. BURR, head of the department of metallurgical engineering, Rensselaer Polytechnic Institute, is a native of Saskatchewan, Canada. He holds B.S. and M.S. degrees in physics from the University of Saskatchewan, and a Ph.D. degree from Pennsylvania State University. He was a teaching assistant at both of these universities before going to Armstrong Cork Co. as research physicist. In 1916 he joined the staff of R.P.I., and in 1955 assumed his present title.

Mr. Burr is a member of several technical societies and is past president and secretary of the Troy Exchange Club. He takes an active part in chapter affairs, having been on the executive committee on and off for 10 years and has also served as educational and program chairman.

Daughter Janet is 8 years old and son Leonard is 3. His other interests are photography, woodworking and gardening.

WARREN

HAROLD BLAIR, maintenance planning engineer, American Welding & Manufacturing Co., was born in Youngstown, Ohio, and acquired his B.S. degree, physics major, math minor, at Youngstown University. He is a registered professional engineer in the State of Ohio.

Mr. Blair worked as a junior engineer, machine designer and assistant chief engineer before being assigned his present position. He has been on the executive committee of the Warren Chapter since 1953.

He and his wife Jean have three boys, David 12, Robert 9 and Christopher 8. He is interested in Little League baseball and plays golf.

ROCKFORD

DONALD A. CAMPBELL is vice-president of engineering and research for Eclipse Fuel Engineering Co. Born in Mexico, he is a graduate of University of Colorado Engineering School with a B.Sc. degree in electrical engineering. For a number of years after graduating he was with H. L. Doherty & Co. in various engineering and sales capacities, with the exception of 15 months overseas service in the U. S. Army Signal Corps during World War I.

Don began specializing in gas combustion equipment in 1928 as sales engineer with Eclipse Fuel Engineering Co., and later he worked at Wheelco Instrument Co. as district representative, and in the Industrial Division of Bryant Heater Co., returning to Eclipse Fuel in 1951 in his present position. He maintains membership in a number of technical societies, several fraternities, and the Advertising Club of New York. His wife is the former Frances M. Stumph of Pueblo, Colo., and they have a son, Don, Jr., and a daughter, Virginia Lee.

HARTFORD

J. C. MCDONALL, salesman for Vanadium-Alloys Steel Co., graduated from Purdue University with a B.S. degree in chemical engineering, and attended Lewis Institute in Chicago and Hillyer College in Hartford for additional training. He worked as plant metallurgist, heat treat foreman and service engineer before assuming his present position.

Mr. McDonall takes a very active part in chapter affairs, having been treasurer, and a member of the executive committee for three years. He also gives time to community service as a member of the board of directors of the Farmington Chapter of the American Red Cross and was chairman of that organization in 1955-57. His lighter interests are fishing and golf and he enjoys wood and metalworking, gardening and masonry. Son Keith is 14 and daughter Claire is 11 years old.

MINNESOTA

NORMAN C. SILVER, metallurgical engineer, Continental Machines, Inc., is a graduate of the University of Minnesota. After leaving college he went to A. C. Spark Plug Div., General Motors Corp., as process metallurgist, metallographer and toolsteel metallurgist. He maintains membership in Sigma Alpha Sigma professional engineering fraternity and Minneapolis Masonic Lodges. Chapter activities include program chairman, vice-chairman and member of the executive committee.

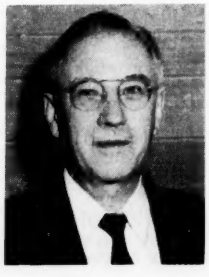
A home workshop occupies some of Mr. Silver's spare time, and he enjoys a game of chess and is interested in sports. His one son, Charles, is 3½ years old.

A. A. Burr

H. Blair

R. L. Cunningham

D. A. Campbell



N. C. Silver

Milwaukee Course Breaks Attendance Records

Part of the Over-Flow Attendance of 480 Persons Who Attended the First of Four Lectures on "Heat Treatment of Steel" Given by Muir L. Frey, Allis-Chalmers Manufacturing Co., Sponsored by the Milwaukee Chapter

Speaker: M. L. Frey
Allis-Chalmers Mfg. Co.

It isn't only baseball and beer that interest the citizens of "The Baseball Capital of the World" judging from the popularity of the **Milwaukee Chapter's** educational course presented by Muir L. Frey of Allis-Chalmers Manufacturing Co., who spoke on "Heat Treatment of Steel", in a series of lectures based on the material prepared by the late Marcus A. Grossmann for A.S.M.

Attendance at this series was so great that a last minute switch of auditoriums was necessary to accommodate the "standing room only" crowd of 480 who attended the opening lecture in September.

Elwood M. Taussig, educational committee chairman, reported a record-breaking average attendance of 444 at the lectures given on four successive Monday evenings. He further added that the interest aroused by Mr. Frey's presentation is best exemplified by the fact that certificates are being awarded to 290 men with 100% attendance records.

Mr. Frey's 35 years of experience cover steelmaking and a wide variety of automotive and aircraft metallurgy. This enabled him to combine sound theory with practical down-to-earth information organized to match the broad heat treating interest in the Milwaukee area.

The subjects covered were "Basic Principles of Heat Treating"; "Hardenability and Transformation During Cooling"; "The Mechanism of Tempering, Normalizing and Annealing"; and "Carburizing and Other Surface Hardening Techniques".—**Reported by E. M. Taussig for Milwaukee.**

Speak on Stainless Aircraft Castings

Walter Dunn, Vice-President and General Manager, Pacific Alloy Engineering Corp., Who Spoke on "Production Capabilities of Stainless Steel Aircraft Castings" at a Meeting of San Diego Chapter, Is Shown, Right, Describing a Casting to George D. Cremer, Chairman, and Edward B. Tilley, Co-Speaker

Speakers: Walter H. Dunn
Edward B. Tilley
Pacific Alloy Engineering Corp.

Walter H. Dunn, vice-president and general manager, and Edward B. Tilley, chief metallurgist, Pacific Alloy Engineering Corp., discussed "Stainless Steel Aircraft Castings" at a meeting held in **San Diego.**

Mr. Dunn presented a progress report showing the potential of high-alloy steel castings for aircraft. Advantages and limitations of castings were outlined, with special attention being given to the methods of producing intricate parts of high quality. Emphasis was placed on the use of vacuum degassing as an aid to quality improvement.

Different steel casting processes were discussed and evaluated. The increasing need for close cooperation between aircraft engineers and foundry engineers was stressed, with highly successful instances of the effects of such cooperation being cited.

Mr. Tilley discussed the development work being done on AM-355 and 17-4 PH as cast materials. A number of slides were used to show the effects of various time and temperature cycles used in heat treatment. Mr. Tilley pointed out that the present standard heat treat temperatures and time cycles do not necessarily give the best possible mechanical properties available in these materials. Special processing and control have shown the feasibility for complex castings that exhibit physical properties in the 200,000 psi. range.

The discussion was concluded with a brief outline of research and development areas considered most promising for exploitation.—**Reported by G. D. Cremer for San Diego.**

Presents Heat Treating Case Histories

E. J. Pavesic, Lindberg Steel Treating Co., Presented "Heat Treating-Case Histories" at a Recent Meeting in Boston. Shown are, from left: Ray Sault, technical chairman; Mr. Pavesic; and Bill Collins, Chapter chairman

Speaker: E. J. Pavesic
Lindberg Steel Treating Co.

"Heat Treating—Case Histories" were discussed in a talk by Edward J. Pavesic, field metallurgist, Lindberg Steel Treating Co., at a meeting held by **Boston Chapter.**

In spite of all the modern equipment, quality control measures and skilled personnel, troubles do continue to arise in heat treating. The cause or causer of these troubles are manifold and may have their origin in the following: misapplication of material; defective material; malpractices in heat treating; abuses in fabrication and machining; or post heat treatment operations such as grinding, pickling or blasting.

Diagnoses of troubles and failures are beset by many complications. One of these complications takes the form of a controversy between the materials engineer, the steel suppliers, the heat treating departments and the metallurgists. Each of these individuals or groups blames the other for the trouble. How often have you heard the phrases: "it was the wrong steel for the job"; "it should have been martempered"; "the steel was dirty—had too many inclusions"; "the design was bad"; "it was too hard (or soft)". These phrases often do explain the cause of the trouble but they often also provide a convenient "whipping boy" because the real answer was not found or it escaped the investigator.

It is relatively easy to find some variable in a failed part that does not conform to requirements or to find something in the microstructure that is not just right. Obviously any deviations from the properties specified should be noted but a final conclusion should not be made until all the facts have been considered.

Often an investigation fails to reveal a positive cause for failure. This is not necessarily due to the fact that there is no assignable cause—it may be due to the fact that the search was not elaborate enough. Stress analyses, for example, are rarely made on failed parts, yet undesirable stresses of a large order of magnitude may be present or may have been present which could have accounted for the failure.

Mr. Pavesic proceeded to illustrate and discuss a number of case histories of failures involving many facets of steel and heat treatment. He stressed the fact that of the case histories discussed, none are encountered with any high degree of frequency.—**Reported by J. B. Savits for Boston.**

Syracuse Members Are Briefed on Toolsteel Trouble Shooting Methods

Speaker: J. S. Pendleton Jr.
Carpenter Steel Co.

J. S. Pendleton, Jr., metallurgist, Carpenter Steel Co., presented a talk on "Toolsteel Trouble Shooting" at a meeting held recently by the Syracuse Chapter.

Most failures in tools and dies can be found in the following areas: Incorrect steel; poor quality of material; improper heat treated condition; faulty setup and alignment; and abuse. These causes can be further subdivided into failures occurring before and after heat treatment.

Before heat treating, the design, as well as the preparation of the stock, is important. Holes near corners in water quenching steels are detrimental, and one of the major causes of failure is due to the lack of stock removal which leaves decarburized layers on surfaces.

The most common source of trouble incurred in the heat treating operation results from overheating. The structure is then coarse and acicular with the presence of retained austenite. The recommended quench should be adhered to and adequate agitation provided to prevent soft spots. The atmosphere utilized should be such that carburization of decarburization does not take place.

The failures that occur after heat treating can be caused by low hardness, poor finishes, decarburization and improper design. Stampings and grinding checks can also lead to premature failures. Slides were shown which illustrated these points. A question period concluded the talk.—Reported by G. Trojanowski for Syracuse Chapter.

Chicago-Calumet Chapters Hear Young

G. M. Young, National President, Presented a Talk Entitled "The Extrusion Process" at the Officers Night Regional Meeting of the Chicago, Calumet and Chicago-Western Chapters. Pictured are, from left: J. F. Schumar, chairman, Chicago-Western; W. H. Eisenman, national secretary; T. Foss, chairman, Calumet; Mr. Young; H. A. Eastabrook, technical chairman; and B. S. Myers, chairman, Chicago. (Reported by D. J. Garibotti)

Talks on Fractography of Molybdenum

Leonard Olds (Left), Denver Research Institute, Who Presented a Talk on the "Fractography of Molybdenum" at a Meeting Held Recently by the Los Alamos Chapter, Is Shown With Morton C. Smith, the Technical Chairman

Speaker: Leonard Olds
Denver Research Institute

At a recent meeting of the **Los Alamos Chapter,** Leonard Olds, Denver Research Institute, presented a well-illustrated lecture on "The Fractography of Molybdenum".

Fractography may be defined as a study of fractured surfaces of crystals. Although fractography is not a new metallurgical technique, it has been developed to its present state only in the past few years.

This technique is useful in studying microporosity, grain boundary phenomena, deformation mechanisms, and the history of crystal growth. Some advantages of fractography over conventional metallography are that a polished surface is not required; a three-dimensional approach is presented; and some types of intergranular segregates can be detected and identified by this method when the quantities present are too small to permit the use of other techniques.

Fractography is also useful in the study of material failures. The type of failure, its origin and its progress can often be deduced from such a study. In common with metallography, the need for careful observation and interpretation is also an essential requirement of fractography. The speaker stressed the fact that fractography in its present state is primarily an art rather than a science.—**Reported by R. W. Keil for Los Alamos.**

A.S.M. created the Annual Teaching Award in Metallurgy, open to teachers of metallurgy in the United States and Canada. Value $2000.

Stanford University Sets Up Metallurgy Department

Stanford University has announced the formation of a new department of metallurgical engineering. Formerly, metallurgical activities were combined with those in mining and petroleum engineering in the Division of Mineral Technology of the School of Mineral Sciences.

During the last few years there has been a great increase in metallurgical activity at Stanford. A long-range program has been undertaken to interest high-school students in this field, as well as to bring the opportunities in metallurgy to the attention of students currently enrolled in the university. As a result, there has been a very significant increase in the student body at both the undergraduate and graduate levels—the total enrollment having increased by a factor of five over the past five years.

In addition, an active graduate research program has been developed. Current research in the department includes work on diffusion kinetics in polyphase systems and systems in which a dispersed second phase is being formed.

Programs are currently being undertaken to study the mechanisms by which dispersed phases affect creep behavior, and the effect of solute elements on the mechanical behavior of grain boundaries at elevated temperatures. A fundamental study of some of the factors that control the creep strength of brazed joints is also underway.

To accommodate these increased activities, considerable improvements have been made in the physical facilities of the department of metallurgical engineering.

Several valuable pieces of equipment have been acquired by the department, including a commercial vacuum melting and casting furnace, new X-ray diffraction spectrometer and fluorescence analysis equipment, and an additional induction heating unit.

Kansas Student Awarded Scholarship

Shown at a Meeting Held Recently by Kansas City Are, From Left: Dave Goldberg, Chairman; Ken Rose, Professor of Metallurgy at Kansas University; Pat Kenyon, Vice-Chairman; and Charles Gibbon, 1957 A.S.M. Scholarship Winner at Kansas University. (Reported by W. H. Deterding)

Sit In on Los Angeles' First Round-Table

Members Who Attended the Round Table on "Can Tool and Die Steels Be Used Advantageously in Structural Components of Airframes and Missiles" Sponsored by the Special Activities Committee of the Los Angeles Chapter

Under the sponsorship of the **Los Angeles Chapter,** the Special Activities Committee held a Metallurgical Round Table discussion on the subject "Can Tool and Die Steels Be Used Advantageously in Structural Components of Airframes and Missiles?"

This round-table approach was established with the prime objective of expanding the services of the Los Angeles Chapter to groups within its membership by organizing meetings where the subject of discussion can be confined to the specific interest of the group concerned. By this informal type of meeting, individual participation is encouraged which allows opportunities not available in the regular meetings to obtain technical details in a particular field of interest—in this case, airframe and missile materials.

The Special Activities Committee, under the chairmanship of Ken Clark, consists of the following members: Bill Ward, Blair Molander, Al Binsacca, J. A. Perduyn, C. W. Funk and R. H. Gassner. Mr. Gassner, chief metallurgist, Douglas El Segundo, was the moderator for this meeting.

A total of 48 people was in attendance, 32 from the aircraft and associated industries, 11 from the producing end, and 5 from heat treating and processing concerns.

An agenda was presented by the moderator and was broken into four categories.

1. What are hot work die steels?
2. What are their properties that make them worthy of consideration for aircraft and missile application?
3. What are the processing difficulties that may be expected in making parts of these materials?
4. What procurement problems are anticipated?

Due to the extensive discussions that were encountered with many of the points that developed, only the first two categories were covered in this first round table.

In the first category classification, grades and history of hot work die steels were discussed. In the second category, the main item discussed was strength at room and elevated temperatures because some data had been developed by the local airframe and missile companies. Hardenability, impact, fatigue and crack propagation were discussed primarily from the standpoint of the need of this type of data to properly utilize tool and die steels in airframe and missile designs.

A few applications of the hot work die steels in sheet form were discussed. Tests made resulted in some brittle-type failures which indicate that structural design and processing are more critical with these types of materials than those normally used.

The main point brought out by this discussion was the fact that extensive testing and process development are in order to prove the reliability of the hot work die steels for airframe and missile applications.

It was agreed that another go-around should be held as soon as possible to complete the first program and it appears that, judging by its first attempt, the Los Angeles Chapter's Metallurgical Round Table will enjoy great success.

National Officers at New York Meeting

The National Officers Night Meeting Held by the New York Chapter Was Host to National President G. M. Young, Aluminum Co. of Canada, Who Presented a Talk on "The History of Aluminum Alloy Development", and to W. H. Eisenman, National Secretary. G. V. Kurdyumov, director of the Institute for Metal Physics and Metallography of the Central Scientific Research Institute for Ferrous Metals in Moscow, gave a talk on the "Effects of Solid Solution on Interatomic Bond Strengths in Iron". Shown are, from left: W. J. Kennelly, Jr., chairman; Mr. Eisenman; Mr. Young; and Frank Malone, vice-chairman. (Reported by A. S. Cohan)

Notes Horizons in Materials Research

Mary Norton, Watertown Arsenal, Technical Chairman, and John H. Hollomon, General Electric Co., Compare Notes at a Meeting of the Boston Chapter. Dr. Hollomon talked on "Horizons in Materials Research"

Speaker: J. H. Hollomon

General Electric Co.

John H. Hollomon, manager, metallurgy and ceramics, Knolls Research Laboratory, General Electric Co., presented a talk before the **Boston Chapter** entitled "Horizons in Materials Research". Dr. Hollomon is a national trustee A.S.M.

He very briefly reviewed the early history of metallurgy and ceramics. About 1850 the relationship of chemistry to metallurgy was first recognized, and combining of ceramics and mineralogy later led to ceramic engineering.

According to Dr. Hollomon, a comprehension of the chemistry of metallurgy is extremely important now that we are in the chemical age of metallurgy. He supplemented his presentation with slides illustrating: United States' production of metals since 1870; the materials temperatures in a Mach 1 engine; the increase of turbo-jet engine performance at Mach 3 by 1965; the increase of materials temperatures with performance, emphasizing combustion liners, blades, buckets and skin materials. He pointed out the limits of skin materials made of aluminum and titanium alloys.

Dr. Hollomon stressed the value of vacuum melting bucket materials and the future trend in the composition of bucket materials. As an example, he illustrated with a slide a coated and uncoated molybdenum alloy bucket after testing at elevated temperatures, thus pointing out the need for chemical protection of molybdenum alloy buckets.

Dr. Hollomon emphasized the importance of understanding the structure in metals for better utilization. Understanding the kinetics of transformation and how it controls structure was mentioned as an advancement in the age of metallurgy. The importance of controlled grain orientation and its effect on properties was also mentioned. The use of X-ray diffraction and the microscope can aid in a better understanding of the structure of metals. Adding insoluble impurity particles in metals will prevent the crystals from growing, thus producing a fine-grained structure which is more ductile. This same principle was applied to ceramics wherein the microstructure and the ductility are controlled. This is considered revolutionary in the field of ceramics. The control of microstructure will have a marked influence upon the future of permanent magnets.

The development of polymers will play an important role in the future. Along with this, the control of atom location will lead to a better understanding of the properties of materials. In discussing the effect of dislocation of atoms and how it reduces the strength of materials, Dr. Hollomon predicted the next age of metallurgy will be the control of atomic structure and not microstructure.

He presented a slide entitled "Distribution of Learning Effort—World Science", which showed that only 4% of world science is in the field of metallurgy.

Dr. Hollomon concluded with the proposal that industrial and educational research be continued in its current vein, but that national research institutes be established in the national interest. — **Reported By Stephen G. Demirjian for Boston.**

Talks on Toughness Without Tempering

Speaker: R. H. Aborn

U. S. Steel Corp.

Robert H. Aborn, director of research, U. S. Steel Corp., was the principal speaker at **Cleveland Chapter's** National Officer's Night Meeting. Dr. Aborn, then treasurer-elect A.S.M. (now treasurer) talked on "Toughness Without Tempering".

The constant search for higher strength materials has forced metallurgists to take another look at martensitic steels, because martensite is the hardest matrix obtainable in steel, and, when suitably tempered, it offers the best combination of strength and toughness.

During this new appraisal, it was discovered that martensite formed in steels containing less than 0.20% carbon showed unusually high strength with good ductility, toughness and formability.

In addition to an extensive comparison of 1013 and 4315 martensites, a number of tests run on steels with a normal 4300 series alloy content and carbon levels of 0.15, 0.20, 0.30, 0.40 and 0.60% in three conditions, as-quenched, quenched and tempered at 400° F., and quenched and tempered to approximately Rockwell C-29. In all cases, the lower carbon steels had superior impact strength.

The greater toughness of low-carbon martensites was explained by a combination of several circumstances.

There is very little, if any, retained austenite in the quenched low-carbon steels and consequently no secondary hardness at low-tempering temperatures. The martensite transformation range in low-carbon steels is high enough (M_f over 600° F.) so that the martensite formed is unavoidably tempered while cooling to room temperature. Such tempering is referred to as "Q tempering".

Studies with the electron microscope have shown that during "Q tempering" minute carbide platelets are precipitated. These carbide particles have been indentified as cementite, or Fe_3C.

High-carbon martensites, on the other hand, with an M_s of 600° F. or less, and an M_f of about 200° F., show no such precipitation as-quenched, because the temperature is too low to allow "Q tempering" and the first carbides precipitated in tempering are epsilon carbides, on the order of $F_{6}12\ C_5$, rather than Fe_3C.

Dr. Aborn presented an unusual film which was taken at 3000 fps. and projected at the normal rate of 16 fps., and showed the changes taking place in a single grain of Type-301 stainless steel while it was being stretched 7%. Actual filming time was one second. The formation and progression of slip lines could be followed very easily, with accompanying transformation to low-carbon martensite.—**Reported by J. R. Shepard for Cleveland.**

Predicts Future Materials Problems

John N. Dempsey, Minneapolis Honeywell Research Center, Spoke on "Materials for the Future" in Minneapolis. Shown, from left: Morris E. Nicholson, vice-chairman; Dr. Dempsey; and Ralph Bowman, executive committee

Speaker: J. N. Dempsey

Minneapolis-Honeywell Research Center

John N. Dempsey, research section head, Minneapolis-Honeywell Research Center, presented a talk entitled "Materials of the Future" at a meeting held in **Minnesota.**

High-temperature materials problems are not only a future requirement but are problems that require solution today. Metals, age-hardened alloys and solid solution hardened alloys have inherent losses of strength at elevated temperatures which exclude them from use. Dispersion hardened materials offer a good possibility as an interim solution to high-temperature problems.

Tremendous effort to increase the service temperature of metals has occurred over the past 10 to 15 years. Much of this work was carried out during and shortly after World War II. However, efforts to exceed a service temperature of 1600° F. have produced literally unsuccessful results. The need is real above this temperature, and radically new and different techniques and concepts will be required if we are to break through this temperature barrier.

Dispersion hardened materials offer one possible solution. A particular class of these materials is cermets, a combination of ceramics and metals, in which, by definition, 30% by volume is the hard or dispersed phase. The ductility problems associated with cermets are severe when the percent of the hard phase is increased to such a level that strength requirements at elevated temperatures are met. It is often difficult, if not impossible, to machine and form these cermets in a conventional manner. An idealized microstructure that would render a cermet more ductile and workable was proposed by Norton many years ago. He suggested that the hard-phase particles be regular in shape and preferably spherical. The Honeywell Research Center has been successful in producing micron-size particles of pure aluminum oxide which are spherical in shape. Marked increases in ductility of cermet-like materials have been noted when spherical particles are used as the hard phase in a metallic matrix.

Oxidation problems and the relatively low melting points of the matrix metals employed impose limitations on the service temperatures of these cermet materials. The real breakthrough in materials technology will come with the development of ductile ceramics. A large amount of effort in the United States is being placed on projects leading to the development of ductile ceramics. Ceramics, as we know them today, have excellent high-strength characteristics, but tend to suffer from the shortcomings of low fracture resistance and a highly brittle nature. An ironical thought is that when ductile ceramics are obtained, it may be necessary to employ conventional techniques of metallurgy to these materials to again regulate and increase their strength in a controlled manner. — **Reported by Paul B. Wallace for Minneapolis.**

—Metals Pace the Progress of Civilization—

Brittle Fracture of Metal Subject at West Michigan

Speaker: E. T. Wessel

Westinghouse Electric Corp.

At a recent meeting of the **West Michigan Chapter** E. T. Wessel, Westinghouse Electric Corp., spoke on "Brittle Fracture of Metals".

Brittle fractures are a serious problem confronting the design engineer. This was illustrated by several failures of this nature which occured in ships, liquid ammonia tank, gas transmission lines and a turbine. In many cases the failure was a potential danger to human life and resulted in extensive structural damage.

Brittle failure was defined as any sudden catastrophic rupture resulting in a bright crystalline cleavage or grain boundary fracture surface. Low temperatures and stress risers tend to increase the tendency for this phenomenon to occur. A graph of stress versus temperature was used to show the relation between various methods of loading and brittle fracture tendency. Other illustrations showed that the lattice structure of the base metal is an important factor in determining susceptibility to a brittle behavior. The relationship of various types of brittle fractures to temperature was illustrated for some materials showing how the mode of fracture changed from all cleavage at low temperatures, to mixed shear plus cleavage at higher temperatures and finally to all shear (ductile) at even higher temperatures.

The brittle-type failure could be considered to be comprised of two stages of stress and strain: a critical level to start a failure; and a lower level to propagate the failure.

In designing, the maximum design stress should not be greater than the fracture propagation stress at the minimum service temperature. A wide band of stress which is questionable for design purposes, particularly at low temperatures, lies above the fracture propagation stress level. The conditions producing the brittle-type fracture should be a consideration in all design work, particularly for materials operating at low tempeatures. Notches, residual stresses, thermal and strain gradients, high-temperature transformation products, and improper weld technique all have a definite effect in promoting brittle fracture.

At the present time there is a lack of suitable testing and data to evaluate brittle fracture behavior in terms of stress and strain. Such attempts are currently being made using large-scale test pieces. Conventional impact test data must be used with caution and should be correlated with service failure information to assure reasonable reliability in its use.— **Reported by R. C. Behnke for West Michigan Chapter.**

—Progress in Metals for Progress in Living—

Note of Appreciation

The letter below was received by Secretary W. H. Eisenman from John C. Kirchner, chairman of the student chapter at Notre Dame University, after his group spent a day at the National Metal Congress in Chicago in November as guests of A.S.M.

"On behalf of our student chapter A.S.M., I wish to thank the National Headquarters and you personally for the invitation to the National Metal Congress and Exposition. The transportation you provided was very thoughtful and the 25-Year Member —Student Banquet was thoroughly enjoyed, I'm sure, by all. The opportunity of seeing the convention was appreciated and I believe utilized to obtain valuable information. Thanks again for affording us this experience".

Stresses Educational Aims in Technology At Meeting in Ontario

Speaker: P. R. Gendron
University of Ottawa

At a meeting of the **Ontario Chapter,** P. R. Gendron, dean of the faculty of pure and applied science, University of Ottawa, spoke on "Education and Modern Technology".

Everywhere we go today, we hear people talking about education. We of the western world are striving to educate the people of underdeveloped countries. In our own hemisphere the accent is on "higher education". Dr. Gendron opened his talk with a question: "What is education?" He then defined education as the process of teaching people to think and to think always for themselves. It is not the mere filling of a student's mind with facts and formula. It is the desire for knowledge; the acquiring of a capacity to question and explore. He pointed out that "wisdom" is the goal of education.

At this point, Dr. Gendron made a distinction between education and technology. Education deals with values, basic concepts, fundamental principles, with causes and the why. Technology, on the other hand, deals with means, techniques, effects and the how to accomplish a goal. Education aims at a better understanding of ourselves, our society and the universe in which we live. Its aim is to develop better citizens with a broader understanding of the rights of others. He pointed out how often ignorance or indifference to civic affairs has led to despotism and slavery. Never has the need been greater for educated people. Technology, on the other hand, has produced such monuments as the St. Lawrence Seaway, our northern radar fences and the great engineering development at Kitimat in British Columbia.

We have both education and technology; both are necessary and they often overlap, according to Dr. Gendron. However, he made one point very clear—it should be the object of the technological studies to produce the architects, the thinkers and the planners. It should produce people with ability to grasp the situation and see the over-all picture. Technological studies should not produce the mechanics, the instrument manipulators and the doers. He strongly criticized those who suggest that our universities should have such courses as "welding engineering". A metallurgist with a good grasp of fundamental metallurgical principles would need but a very few lectures on the subject to know all that is required of an engineer. Training of welders should be left to technical schools.

Dr. Gendron pointed out that to produce a student with the right proportion of education and technology is very difficult. He contrasted the process with the making of an alloy. With the sound knowledge of metallurgical principles it is possible to predict, and with known alloys, to control the properties that we can expect from this alloy. Nor do we have to spend too much time or effort in preparing the crucible. Such is not true in producing a "student alloy". The crucible is that very complex thing, the brain. The ingredients are the student's background, time, the staff and equipment available, and finance—all great variables in themselves.

Dr. Gendron pointed out that the two greatest variables are the student's background and time. The background can be complicated by many factors in family life, such as the insecurity of a broken home. It can be further complicated by religious beliefs varying from radical dogmatists of various religions on the one end to radical atheists on the other end. The various social levels of the student body produce a wide variety of aims and objectives. Finally, the prior preparation in grade and secondary schools often leaves much to be desired.

Time is the other great variable in producing a good student. Because of our complex technological world, a student must specialize. He simply does not have the time to study everything. Secondly, in any course he must have time for creative thought. This then presents one further point. If he must study all the prescribed subjects and still have time for creative thinking, as in his various laboratory courses, how then can we introduce more nontechnical subjects, the humanities? However, these humanities are important, because the student of today must not only be a good scientist or engineer, he must be a good citizen. He must think globally and be broadminded, since so many of these people are today finding their way into business and politics at every level of human endeavor.

In closing, Dr. Gendron again stressed his point—let the universities teach the fundamental and basic principles of science—let the technical schools train the technicians.—**Reported by W. Roy Ellis for Ontario.**

Describes Brittle Behavior of Steels

National Vice-President C. H. Lorig (Center), Is Shown With Leonard Ewalt, Chairman (Left), and Joe Phillips, Technical Chairman, at a Meeting of Purdue Chapter. Dr. Lorig spoke on "Brittle Behavior of Ferritic Steel"

Speaker: C. H. Lorig
Battelle Memorial Institute

At the National Officers's Night meeting of the **Purdue Chapter,** C. H. Lorig, Battelle Memorial Institute, and vice-president A.S.M., spoke on "Brittle Behavior of Ferritic Steel".

The bursting of turbine rotors and the halving of ships are good examples of the brittle behavior of steels. The suppression of brittle behavior and the temperatures at which the ductile-brittle transformations take place were the main points brought forth in the talk.

Temperatures of transformation vary over a range from about —300° F. to 300° F., but the actual temperature of the transformation is dependent upon the steel and the type of impact test used. The addition of manganese to steel generally decreases the sensitivity of the steel to embrittlement, and the notch-ductile steels produced in England are a result of this discovery. Grain size and the distribution of carbides are other factors which determine the temperature of transformation; quenching, tempering, and normalizing practices are also important.

To summarize the talk, Dr. Lorig pointed out that brittle behavior of ferritic steels is affected by the material being tested (lattice structure, chemical composition, microstructure); temperature of testing; nature of the stress system; and the speed of loading.—**Reported by Terrance Lindemer for Purdue Chapter.**

Defines Role of Metallography

Robert J. Gray, Chief Metallographer at Oak Ridge National Laboratory, Spoke on "Metallography and Its Contribution to Metallurgy" at a Meeting Held in Philadelphia. At the meeting were, from left: George H. Baile, entertainment chairman; R. G. Smith, Americans for the Competitive Enterprise System, Inc., coffee speaker; Charles A. Turner, vice-chairman; Dr. Gray; and A. Craig Hood, the program chairman

Speaker: Robert J. Gray
Oak Ridge National Laboratory

Robert J. Gray, chief metallographer of the Oak Ridge National Laboratory, spoke on "Metallography and Its Contribution to Metallurgy" at a meeting held by **Philadelphia.**

It is of prime importance to prepare a representative surface in any metallographic work. Distorted metal resulting from cold work during the preparation of the sample, or other abuse, cannot be tolerated if modern standards are to be met.

In many cases it is an advantage to use more than one etch to bring out the true structure of a sample. This is especially important in the preparation of a sample of multiple materials, such as clad metals and fuel elements for atomic reactors. The use of a single etchant could result in the severe overetching of one portion of the sample and underetching of other parts. By the use of an etch technique, known as vacuum cathodic etching, all portions of the sample can be etched to show their true structure.

We are approaching the limits of the light microscope in our work and it is increasingly important to use the electron microscope to bring out structures that are beyond the resolution of the light microscope. Mr. Gray said it had been reported to him that the Russians are using the electron microscope almost as much as the light microscope in their research work.

Mr. Gray showed a series of slides picturing the Oak Ridge metallographic equipment. Many problems associated with metallurgical research in the field of atomic energy must be approached with special equipment and highly developed techniques. In addition, the metallographer is faced with the problem of handling radioactive and/or toxic materials, which must be undertaken with caution. He showed many examples of the type of work being done at Oak Ridge, with special emphasis on the use of color photomicrography. Some specific examples were shown of the important part metallography has played in the solution of metallurgical problems.—**Reported by A. A. Bradd for Philadelphia Chapter.**

—Security and Progress Through Metallurgy

Golden Gate Schedules Heat Treat Conference

The **Golden Gate Chapter** willl stage the first annual Western Welding, Brazing and Heat-Treating Conference on Mar. 27-28, 1958.

Stanford Research Institute will host the two-day meeting of industry representatives from the 11 western states. All conference business will be transacted at the Menlo Park, Calif., applied research center.

The meeting has been scheduled because of the major new joining and heat treating problems that have been created by technological development since World Was II, according to W. J. Erichsen, chairman of the Golden Gate Chapter.

Ten sessions led by experts from joining and heat treating industries throughout the country will deal with a number of current problems faced by the industry. The sessions are: "Analyses of Welding Problems in Joining High-Temperature Metals"; "Recent Progress in Brazing High-Temperature and Unusual Metals"; "Special Problems in Heat Treatment of High-Temperature Metals and Alloys"; "Welding Problems in New Petroleum and Chemical Processes"; "New Developments in Corrosion-Resistant Materials for Petroleum and Chemical Service"; "Brazing and Heat Treating Problems in the Aircraft and Missile Programs"; "Low and Medium-Temperature Brazing for the Electronics Industry"; "Welding, Joining and Heat Treating Problems in Nuclear Power Plant Fabrication"; "Quality Control of Welding Applied to Nuclear Submarine Construction"; and "Welding Problems Involved in Ship Structures".

In addition to the technical sessions, there will be round-table question-and-answer panels at the close of each day. A special ladies program has been scheduled.

Cooperating organizations are the San Francisco and Santa Clara Chapters of the American Welding Society and the Santa Clara Chapter A.S.M.

Further particulars are available by writing the conference secretary, E. R. Babylon, Kaiser Steel Corp., 1924 Broadway, Oakland, Calif.

—Metals Mark the Progress of Civilization

Fatigue Durability of Carburized Steel Is Topic at Fort Wayne

Speaker: George H. Robinson
General Motors Corp.

Members of the **Fort Wayne Chapter** heard George H. Robinson, supervisor of ferrous metallurgy in the metallurgical engineering department of the General Motors Corp.'s Research Staff, speak on "Fatigue Durability of Carburized Steel". This talk was presented at the National Metal Exposition in 1956 and has recently been published as an A.S.M. book.

Mr. Robinson discussed the effect of differences in processing on the residual stresses in carburized parts. Such things as case depth, type of steel, section size, tempering temperature. refrigeration and type of fatigue were investigated. It was found that: The method of carburizing makes no difference in the residual stress pattern; residual stresses are highest on material having the lowest core hardness; maximum stress is independent of case depth; residual stresses are reduced by tempering; residual stresses are independent of refrigeration; and residual stresses are not cyclic stress dependent under unidirectional bending conditions.

One of their most interesting findings is that electropolishing about 0.002 in. off the surface of a carburized part appreciably increases the fatigue strength. The reason for this has not become apparent as yet. Using gas, pack or salt bath carburizing, and even special atmospheres, revealed the same results, that is, electropolishing after carburizing appreciably increases the fatigue resistance. The question therefore still remains, "What is wrong with the surface of carburized parts?"—**Reported by N. L. McClymonds for Fort Wayne.**

Quarterly preprint list

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The Board of Trustees of the American Society for Metals, at their Aug. 30-31, 1956, meeting, authorized the quarterly preprinting of technical papers that have been approved by the Transactions Committee. Papers may be submitted to A.S.M. at any time and will be placed on review of the Transactions Committee as they are received. Accepted papers will be preprinted immediately.

The four papers herewith listed are now available for distribution to the members of the Society requesting them. A brief abstract of each paper is included.

72. Constitution of Rhenium-Molybdenum Alloys, by J. M. Dickinson and L. S. Richardson, Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mex.

The rhenium-molybdenum system has been investigated and a constitutional diagram has been proposed. Two intermediate phases, σ (Re_3Mo_2) and χ (Re_3Mo), were found. σ undergoes a peritectic decomposition at 2645°C. (4795°F.) and χ undergoes a peritectoid decomposition at 2080°C. (3775°F.). There is a eutectic at 2505°C. (4540°F.) at 65 wt. % rhenium. Molybdenum dissolves up to 59 wt. % rhenium; rhenium dissolves up to 12 wt. % molybdenum.

73. Activation Energies for Creep of Polycrystalline Copper and Nickel, by P. R. Landon, J. L. Lytton, L. A. Shepard and J. E. Dorn, Department of Engineering, University of California, Berkeley, Calif.

Activation energies for creep of polycrystalline copper and nickel were obtained by the technique involving the effect of an abrupt change in temperature on the creep rate. In general the activation energy for creep was found to increase with increasing temperatures from a low value of about 3000 to 5000 calories per mole at 78° K. to that for self-diffusion at the highest temperatures. The experimental results were discussed in terms of dislocation intersection, cross-slip, solute atom locking and climb mechanisms for creep.

74. Transformation Characteritics of Dilute Ternary Alloys of Uranium, by Daniel J. Murphy, Professor of Metallurgy, University of Arizona, Tucson, Ariz.

A series of ternary additions of niobium, platinum and molybdenum, of the order of 1.0 w/o and less, have been made to binary uranium-0.5 w/o titanium, an alloy of some promise in the γ-heat treated, water-quenched condition. Jominy bars of nine such alloys were tested, microstructurally examined, and hardness profiles obtained over their length.

This paper deals with observations made for correlation of transformation behavior, microstructure and hardness profiles over the spectrum of cooling rates experienced, directed toward the end of determining the effect of ternary additions in improving the properties of uranium.

75. Influence of Forging Temperature in Mechanical Properties of Al-V Titanium Alloys, by Leonard S. Croan, Physical Metallurgist, and Fortunato J. Rizzitano, Mechanical Engineer, Special Projects Section, Watertown Arsenal Laboratories, Watertown, Mass.

An investigation to determine the effects of forging temperature on the mechanical properties after heat treatment of several heats of 6% Al-4% V and 7% Al-4% V titanium alloys was conducted at Watertown Arsenal. As a result of the study, a high-temperature production forging technique involving press forging from above the beta transus temperature and water quenching from the press has been developed. Toughness, as measured by V-notch Charpy impact resistance at −40° F., may be increased by as much as 50% without any significant effect on strength. Although a gradual loss in ductility results from the use of increasingly high forging temperatures, the loss is insignificant at the working temperatures recommended. By applying these techniques, advantages of improved forgeability, optimum combination of the more important mechanical properties and reduced costs may be realized. The forging techniques developed have already been applied in processing more than 10,000 lb. of closed-die forgings at Watertown Arsenal.

OBITUARIES

ADELBERT R. ROBERTSON, president and secretary of the Wayne Industrial Furnace Co., a member of the Detroit Chapter, died late in October.

THOMAS D. HAYES passed away early in October at the age of 66. He had been with U. S. Steel Corp. in Chicago for 23 years, retiring in March 1956. He had been a member of A.S.M. since 1918.

KARL E. HENRIKSON, metallurgist for Link-Belt Corp., and a member of Cedar Rapids Chapter, died in October at the age of 55.

THORSTEN Y. OLSEN, chairman of the board of Tinius Olsen Testing Machine Co., died Dec. 10 at the age of 78. Mr. Olsen joined the company founded by his father, Tinius Olsen, in 1930, and took an active part in the development of physical testing machines of all types, as well as static-dynamic balancing machines. He was a graduate of Cornell University, with a degree in mechanical engineering, in 1903. He was named vice-president and treasurer of the Olsen Co. in 1912, and president and treasurer in 1929. He relinquished the presidency to his son, Tinius Olsen II, in 1955 and remained as chairman of the board, in which capacity he served until his death.

ALTON V. POLLARD, a life member of the American Society for Metals and a past chairman of the New Haven Chapter, was drowned in a fishing accident off the coast of Florida on Dec. 4.

W. M. C. Conferees Guests at Oak Ridge

The Oak Ridge Chapter Was Host to World Metallurgical Congress Tour No. 9 Conferees on Their Way to the Congress in Chicago. A lecture on the Great Smoky Mountains National Park was presented after dinner by Henry E. Lix, park naturalist. W. O. Harms, chairman, welcomed the conferees for the Chapter, and G. J. Metcalfe, Hawker Siddeley Nuclear Power Co., Ltd., England, formally expressed the appreciation of his group for the evening. Shown, top, from left: D. A. Douglas, Oak Ridge National Laboratory; Mr. Metcalfe; W. T. Davies, Rolls Royce, Ltd., England; E. E. Stansbury, University of Tennessee and trustee A.S.M.; P. Patriarca, Oak Ridge National Laboratory; and H. E. Dixon, Atomic Power Constructions, Ltd., England. Second photograph, from left: C. Fizzotti, Centro Informazioni Studi Esperienze, Italy; G. E. Darwin, Atomic Energy Department, Babcock & Wilcox, Ltd., England; W. S. Dritt, Oak Ridge National Laboratory; and E. L. Long, Oak Ridge National Laboratory. Third photograph, from left: Gunji Shinoda, Osaka University, Japan; C. J. McHargue, Oak Ridge National Laboratory; J. E. De Graaf, Technological University, Holland; W. O. Harms, Oak Ridge chairman. Fourth photograph, from left: E. H. Parfrey, Nuclear Power Branch, Central Electricity Authority, England; C. J. McHargue, Oak Ridge National Laboratory; A. T. Churchman, Associated Electrical Industries, Ltd., England; R. A. Skinner, John Thompson Nuclear Energy Co., Ltd., England; and B. C. Woodfine, General Electric Co., Ltd., England

Size Changes in Steel Topic at Chicago-Western

Speaker: S. G. Fletcher

Latrobe Steel Co.

S. G. Fletcher, vice-president, metallurgy, Latrobe Steel Co., delivered a talk to the **Chicago-Western Chapter** entitled "Dimensional Changes in Steels as Influenced by Microstructure".

Hardenable steels undergo dimensional changes during heat treating and sometimes upon holding at room temperature. Shrinkage, growth and/or distortion may result. These changes and the factors which control them are of the greatest interest to the manufacturers of precision parts such as, gages, dies, jig fixtures, etc.

Dimensional changes may be caused by shape changes due to internal stresses, and warping distortion caused by thermal stresses or mechanical working, and/or size or volume changes which are brought about by phase changes in the atomic structure.

Shape changes do not involve any volume change but rather are due to deformation and furthermore can be controlled to some degree by proper heat treating procedures. They are due to internal stresses, which may arise through mechanical sources such as plastic deformation, machining, grinding, and thermal sources, such as uneven heating, and/or quenching.

Dr. Fletcher outlined a series of rules designed to avoid irreversible size changes resulting from internal stresses: (1) Keep parts uniform and symmetrical; (2) stress relieve; (3) heat as slowly and quench as uniformly as possible. Heat treaters have learned through experience to adhere to the above rules as much as possible.

Size or volume changes in steels are due to the fact that ferrite, upon heating, transforms to a closer packed structure, austenite, which in turn, on quenching, transforms to martensite. The latter has a larger volume than austenite, and sometimes than ferrite. These dimensional changes are characteristics of an alloy for a particular heat treating cycle.

From the lattice parameters of the above-mentioned phases one can calculate the influence of carbon on volume changes during heat treating. Furthermore, if the amount of the various phases present after heat treatment is known, it is possible to calculate the resulting size change. The above statements apply only if the steel is isotropic as far as composition and structure are concerned, and if no stresses are present.

Dr. Fletcher then showed, by means of calculations, that an oil hardening toolsteel, 0-1, with a metallographic structure consisting of 84% martensite, 13% austenite and 3% cementite after quenching will exhibit a linear dimensional increase of 0.0019 in. per in. This value has been found to check quite closely with the actual observed changes. In this and other hardenable steels it is possible to obtain a shrinkage as the percent retained austenite is increased above certain levels.

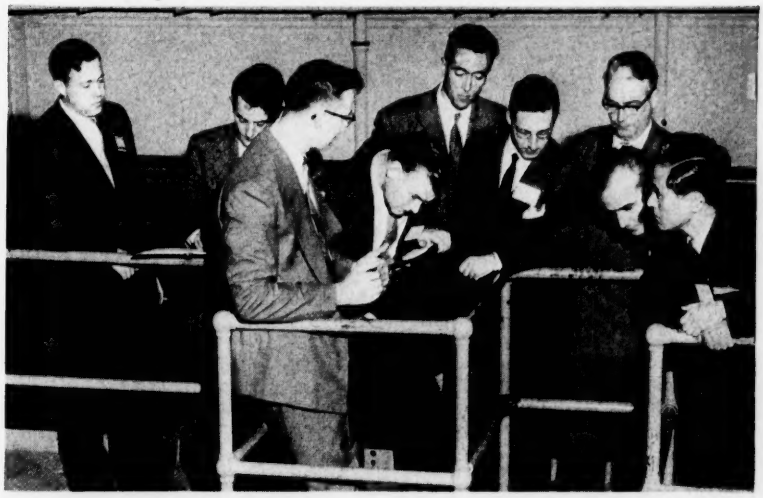
Theoretically, a dimension in any of the principal directions should exhibit a dimensional variation equivalent to ⅓ of the over-all change; however, this does not necessarily hold because steels are neither completely isotropic nor structurally uniform. The unpredictability of these changes was clearly demonstrated by a few slides illustrating dimensional changes in the principal directions versus tempering temperatures for several die steels. Often heat treaters are blamed for these peculiar behaviors, but actually they are inherent to the steel.

Theoretically, to achieve dimensional stability as a function of time at any one temperature, it is necessary to have stable structures. Retained austenite and martensite are not stable at room temperature. Retained austenite should be transformed by subzero treatments, martensite tempered at sufficiently high temperatures to prevent further changes.

To illustrate the role that retained austenite plays on dimensional instability, Dr. Fletcher stated that if 1% retained austenite in a 0.9% C steel transforms during aging at 70° F., a growth of 0.00014 in. per in. results. Such changes cannot be tolerated in precision parts, especially in view of the fact that hardenable steels usually have higher percentages of retained austenite after heat treating unless subzero treatments are carried out.

In summarizing, Dr. Fletcher stated that it is possible to predict size changes from the amount of each phase present, but unfortunately, it it very difficult to predict their magnitude in different directions, and shape changes during heat treatment and their causes are not fully understood but may be minimized by the previously mentioned techniques. A short question and answer period concluded the meeting.—**Reported by D. J. Garibotti for Chicago-Western.**

Conferees Tour Battelle Institute



Enroute to the 2nd World Metallurgical Congress in Chicago, an International Delegation of Metallurgists Visited Battelle Memorial Institute. The 36-man team inspected the research center's atomic energy laboratories and heard a number of reports by Battelle staff members on current peacetime and industrial applications of atomic power. Shown inspecting a reactor from a bridge above the water-filled shielding tank in which the reactor is confined are, from left: Dan Rosenbaum, Battelle; D. Francois, French Commission for Atomic Energy; W. R. Morgan, Battelle; George Ardley, English Electric Co.; A. C. Zanetto, French Commission for Atomic Energy; G. E. Fodor, Trefileries et Laminoirs de Precision, France; K. Sedlatscheck, Metallwerk Plansee, Austria; Michel Ferry, French Commission for Atomic Energy; and Masao Kawabata, Nippon Yakin Kogyo Co., Japan. (Photograph courtesy of Battelle Memorial Institute)

Compares Grinding and Honing Methods

Photographed at a Meeting of the Puget Sound Chapter Were, From Left: A. G. Groom, Micromatic Hone Corp., Who Spoke on "Mechanisms of Grinding and Honing"; D. Meslang, Outgoing Chairman Receiving Certificate From C. B. Holder, Incoming Chairman; and J. W. Sweet, Vice-Chairman of the Chapter

Speaker: Andrew Groom

Micromatic Hone Co.

Andrew G. Groom, manager of the Los Angeles Branch of Micromatic Hone Corp. of Detroit, addressed the **Puget Sound Chapter** on the "Mechanisms of Grinding and Honing". He pointed out the limitations and advantages of each method for producing desired machine finishes. Although many machining methods are completely satisfactory for producing good finishes on steel parts below a hardness of Rockwell C-45, it is left to processes like honing or grinding to finish harder material.

The only real likeness in the two processes is that they both use bonded abrasives. Grinding is accomplished using a limited surface contact, literally pounding away the material. The process introduces high-tensile stresses in the surface and underlying compressive stresses. This undesirable stress gradient is further complicated by a fragmentation of the surface material, producing a noncrystalline or amorphous layer. Grinding wheels must be intermittently dressed to free them of occluded particles and provide a good cutting surface. In honing, the principle of material removal differs in that there are large multiple areas of work contact. The operation consists of a combination of reciprocating and rotating motion, so that the stones are self-dressing. Speeds are in the nature of 60-300 ft. per min., which avoids overheating and leaves the surface material in a crystalline state.

In the discussion that followed, the theory of RMS, waviness and lay were covered. It was concluded that proper surface condition provided better lubrication, smoother running and more assurance of freedom from galling, thus providing greater service life and improved performance.— **Reported by J. Kamitchis for Puget Sound Chapter.**

Titanium-Bearing Slag Is Subject at Quebec Meeting

G. G. Hatch, plant superintendent, Quebec Iron and Titanium Corp., presented a talk on "Production of Titanium-Bearing Slag and Iron From Allard Lake Ilmenite Ore" at a meeting held by **Quebec Chapter.** Since this material is scheduled to appear in *Metal Progress* in the near future, it will not be reported here.

Tour Brewing Plant

Approximately 65 members of **Baltimore Chapter** toured the brewing facilities of the Guenther Brewing Co., which played host to the Chapter for a buffet supper.

Movies of the 1957 Baltimore Orioles were shown and other entertainment included a barbershop quartet, the Marylanders, which harmonized on a number of well-known songs. — **Reported by E. C. Beatty for Baltimore Chapter.**

Oak Ridge Holds Career in Metals Day

Lanny K. Walker, University of Tennessee Student, Is Shown Demonstrating the Operation of a Tensile Test Machine During a Meeting Sponsored by the Oak Ridge Chapter and the University Which Featured "Careers in Metallurgy" for High-School Students. Mr. Walker is an A.S.M. Foundation for Education and Research Scholarship holder at the University of Tennessee

The **Oak Ridge Chapter** and the metallurgy department of the University of Tennessee sponsored a "Career in Metallurgy" meeting at the University which was attended by 350 high-school students and teachers from 30 local high schools. An introductory lecture was presented by E. E. Stansbury, professor of metallurgy, University of Tennessee, which emphasized the importance and the place of the metallurgical field and metallurgists in modern civilization. The lecture was illustrated with colored slides of microstructures, production processes and production equipment, and featured demonstrations of the recalesence of transforming steels and a zinc-base aluminum alloy. The lecture was followed by a tour of exhibits and the metallurgical laboratories of the University with demonstrations of operating equipment and of research and laboratory techniques. A.S.M. members served as guides.

A certificate of scholarship award was presented to Lanny K. Walker, recipient of an A.S.M. Foundation for Education and Research Scholarship in 1957 at the University of Tennessee.

The program was well received by the students and the teachers. The question most frequently asked was: "When are the other engineering societies going to do this?"

The program and tour were planned and the student contacts made by Eric Wischhusen and D. L. McElroy, chairman and member, respectively, of the student affairs committee.— **Reported by M. L. Picklesimer for Oak Ridge Chapter.**

Presents Woodside Lecture in Detroit

Robert F. Thomson (Left), Head, Metallurgical Engineering Department, Research Staff, General Motors Corp., Is Shown Receiving the Woodside Memorial Lecture Certificate From O. W. McMullan, Bower Roller Bearing Co., Technical Chairman, at a Meeting Held Recently by the Detroit Chapter

Speaker: R. F. Thomson

General Motors Corp.

The 15th annual William Park Woodside Lecture was presented to the **Detroit Chapter** by R. F. Thomson, head of the metallurgical engineering department, research staff, General Motors Corp. The title of Dr. Thomson's talk was "Are Metallurgists Prepared for 19XX?"

Dr. Thomson prefaced his talk with a brief resume of instances in our technological progress which supported the thesis that man's progress has generally been dependent on the prior development of tools which made the new advances possible. The speaker then described some of the tools available to the scientist or engineer and how these tools may be used in the solution of present-day problems related to nuclear power, space travel, supply, component part improvement, etc.

The tools of progress discussed by the speaker included man power, financial support, understanding, available materials, tools for producing new materials and tools of measurement. In the field of man power and financial support it was shown that there has been a rapid growth in the numbers and quality of training of persons devoted to scientific and engineering work and in necessary financial support. With this increase in more and better man power and funds, understanding of physical phenomena will increase at an accelerating rate. The speaker commented that in the past understanding generally has followed invention, but in the next half century an increasing number of developments may grow out of understanding of physical phenomena and this may well be the most outstanding contribution which will be made in the next half century, according to Dr. Thomson.

Materials are available to us in two different senses. One involves how much is available, the other, what it can do. In regard to how much is available, the speaker said that ominous predictions in the past regarding our materials reserves were made, not considering advanced technological progress or changing economic conditions. The use of taconite ores was cited as an example. To win these materials from low-grade ores greater quantities of energy will be required. This energy may be considered to be available from petrochemical, nuclear and solar sources. While the total of these reserves seems adequate for present and future needs, problems in making low-cost energy available from nuclear and solar sources still remain to be solved. What materials can do for us evolves around what can be done to take advantage of existing properties and how to process these materials to enhance specific properties to suit our needs.

A processing method employing high temperatures and pressures has already been proven to be a useful tool in the preparation of hard materials. Means for producing higher temperatures and concentrated energy were discussed as tools for producing new materials. Methods reviewed included the use of high exothermic fuels, induction heating and electron bombardment. Theoretically it was shown that if sufficiently high temperatures could be attained and contained, the reduction of metals from their oxides might be accomplished without the need for reducing agents such as carbon. Methods for producing the required temperatures are available; the problem now is one of containment.

In discussing tools of measurement, Dr. Thomson described the electron probe microanalyzer, the mass spectrograph and the ionic field emission microscope. He concluded with a brief summary of a few of the problems facing us in 1957 and how existing tools may aid in their solution.—**Reported by R. B. Boswell for Detroit Chapter.**

Carnegie Student Gets Scholarship

R. F. Mehl, Dean of Graduate Studies at Carnegie Institute of Technology, Is Shown Presenting an A.S.M. Scholarship to Larry E. Campbell, Student at Carnegie Tech, During a Meeting Held Recently by Pittsburgh Chapter

Thanks, Dr. Hume-Rothery

W. Hume-Rothery, department of metallurgy, University Museum, Oxford, England, who was made an honorary member A.S.M. during the recently held World Metallurgical and National Metal Congress, wrote the following letter of acceptance since he was unable to be personally present to receive it.

"I have now received the Diploma for Honorary Membership which was accepted by Anthony Post on my behalf. I need not say how much I would thank you and the American Society for Metals for the honor which you have done me, and I am only sorry that I was not able to attend myself. We have had an exceptionally busy term, moving into new quarters and also planning an entirely new laboratory whose building is to begin very soon.

"You will like to know that, in the last few weeks, I have been elected first Isaac Wolfson Professor of Metallurgy in the University, and it is nice to feel that metallurgy is now properly established.

"I hope that, if you are in England, you will visit us at Oxford and see some of our work.

"Again with many thanks, Yours sincerely". W. Hume-Rothery.

—Modern Metals Foretell Tomorrow's Marvels—

Quebec Hears Talks on Nondestructive Tests

Speaker: W. E. Havercroft

Dept. of Mines & Technical Surveys

W. E. Havercroft, Department of Mines and Technical Surveys, Ottawa, Canada, spoke on "Nondestructive Testing" at a meeting in Quebec.

Although Mr. Havercroft covered all nondestructive testing methods, he emphasized his philosophy of testing. As far as any particular test is concerned, its limitations are often as important as its capabilities.

In general, there is no absolute nondestructive test. Most tests are limited to certain materials and, under certain conditions, can cause harm to the degree where the serviceability of the item tested is affected. Even X-ray tests are limited. Simple static electricity marks and pressure spots on the film can be very misleading. With the more subtle tests the limitations are not as obvious and often trap the unwary.

Although X-ray, magnetic particles, ultrasonics and penetrants are considered the "big four" of the nondestructive tests, there is another test which is probably as important as these, but it is rarely properly utilized. This is simply visual observation. The majority of the defects detected by the exotic testing methods are indicated by surface conditions. Proper observation can often replace the more complex tests.—**Reported by C. Briercliffe for Quebec.**

Speaks on Titanium and Zirconium

W. A. Aschoff, Oregon Metallurgical Corp., Spoke on "Properties and Formability of Titanium and Zirconium" at a Meeting of Columbia Basin Chapter. He is shown (right) with the technical chairman Robert S. Kemper

Speaker: W. A. Aschoff

Oregon Metallurgical Corp.

W. A. Aschoff of the Oregon Metallurgical Corp., presented a talk at a meeting of the **Columbia Basin Chapter** on "Properties and Formability of Titanium and Zirconium".

He reviewed the historical development of equipment and techniques used in the melting and casting of reactive metals, with special emphasis on the rapid acceleration of developments which have been made during the past decade.

It was pointed out that since titanium and zirconium have properties that make them especially attractive to the nuclear and aircraft industries a stimulus was provided for rapid progress in their refinement, melting and forming.

Descriptions of current arc-melting furnaces and techniques were supplemented by slides. In addition, a color time-magnified film showing a series of arc and melt behaviors with gas pressure and composition as a variable was presented. The slides and color film were provided by the U. S. Bureau of Mines, Albany, Oreg.

A number of specimens cast to various shapes and sizes were exhibited to illustrate special techniques. Included were centrifugal cast sections of pipe and tubing.—**Reported by W. V. Cummings for Columbia Basin.**

Reviews Metallographic Techniques

From Left: C. B. Craver, Treasurer, A. A. Burr, Chairman, G. L. Kehl, Columbia University, and F. Ver Snyder, Technical Chairman, Are Shown at a Meeting Held by the Eastern New York Chapter. Dr. Kehl gave a talk entitled "Metallographic Techniques". (Reported by W. Fitzgerald)

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month

Prepared at the Center for Documentation and Communication Research,
Western Reserve University, Cleveland,
With the Cooperation of the John Crerar Library, Chicago.

Annotations carrying the designation (CMA) following the reference are published also in *Crerar Metals Abstracts.*

General Metallurgy

1-A. Scrap Control in Nonferrous Foundries. Martin G. Dietl. *Foundry*, v. 85, Nov. 1957, p. 106-109.
(A8d; EG-a38, RM-n)

2-A. Molybdenum—a Versatile Metal. G. L. Miller. *Industrial Chemist*, v. 33, Oct. 1957, p. 509-518. (CMA)

History, occurrence, ore production, processing, production of different forms, applications, and physical and corrosion resistant properties. The total known molybdenum reserves of the U. S. would last 100 years at the present rate of exploitation. (A general; Mo)

3-A. Science for Electroplaters. Pt. 30. Acidification of Cyanide Waste. L. Serota. *Metal Finishing*, v. 55, Nov. 1957, p. 72-75.

Acid treatment method based on the volatility of hydrogen cyanide when cyanide waste is treated (decomposed) by an acid. (A8d, L17)

4-A. Radiation and Metals. A. E. Williams. *Metal Industry*, v. 91, Oct. 25, 1957, p. 359-362.

Industrial applications of radioisotopes; metal penetration by gamma rays; effects of radiation on solid matter; changes in elastic properties; study of porous metal coatings; thickness gages using isotopes; application to galvanizing wire and vacuum metallizing. 3 ref.
(A general, S general, Q21, 2-67; 14-63)

5-A. (Italian.) **Determination of Foundry Costs.** Eraldo Lotti. *Fonderia Italiana*, v. 6, Sept. 1957, p. 355-360.

Cost analysis method in use for many years in FIAT foundries.
(A4s, E general)

6-A. (Italian.) **Quality Alloy Cast Irons.** Giorgio Giacomelli. *Fonderia Italiana*, v. 6, Sept. 1957, p. 361-366.

Characteristics imparted to cast iron by Ni, Cr, Mo, V, Ti and Cu; methods of making additions; compositions, structures and mechanical properties of high-strength, corrosion, abrasion and heat resistant alloy cast irons. (A general, 2-60; CI, *Ni, Cr, Mo, V, Ti, Cu*)

7-A. (Norwegian.) **Safety and Sanitation in Welding.** *Teknisk Ukeblad*, v. 104, Apr. 4, 1957, p. 268-270.

Hazards and damage possible in different methods of welding; new protective measures.
(A7p, K general)

8-A. Fabrication of Uranium and Its Alloys. E. C. W. Perryman. *Canadian Mining and Metallurgical Bulletin*, v. 50, Sept. 1957, p. 574-579.

Effect of thermal cycling and radiation on dimensional and mechanical properties of U. Casting, rolling, extruding and heat treating U and its alloys. 6 ref. (A general; U)

9-A. Zirconium and Tantalum. G. L. Miller. *Chemical and Process Engineering*, v. 38, Oct. 1957, p. 389-390. (CMA)

(A general, T29, 17-57; Zr, Ta)

10-A. Industrial Hygiene of Metals of Recent Industrial Importance. H. H. Schrenk. *Industrial and Engineering Chemistry*, v. 49, Sept. 1957, p. 87A-88A.

Toxicity of boron and boron compounds, Zr, Mo, Ge, Cb, V, Ce, Cs, La, Pr, Nd, Y. Methods of determination of boron in atmosphere and in biological specimens.
(A7; B, Zr, Mo, Ge, Cb, V, Cs, La, Pr, Nd, Y)

11-A. Dust and Fume Control. J. C. Somers. *Mechanical Engineering*, v. 79, Nov. 1957, p. 1022-1024.
(A7, A8a)

12-A. Vacuum Metallurgy. R. C. Bertossa. *Mechanical Engineering*, v. 79, Nov. 1957, p. 1039-1041.
(A general; 1-73)

13-A. Rare Earth Metals. Their Properties and Industrial Application. Felix Trombe. *Metal Treatment and Drop Forging*, v. 24, Oct. 1957, p. 421-424. (CMA)

(A general; EG-g)

The subject coding at the end of the annotations refers to the revised edition of the ASM-SLA Metallurgical Literature Classification. The revision is currently being completed by the A.S.M. Committee on Literature Classification, and will be published in full within the next few months. A schedule of the principal headings in the revised version was published in the February issue.

14-A. Trends in the Major Nonferrous Metals. P. F. Whelan. *Mine and Quarry Engineering*, v. 23, Oct. 1957, p. 440-442.

Brief statistical survey of production of Cu, Pb, Zn and Al over last 50 years. (A4p; Cu, Pb, Zn, Al)

15-A. Past and Future Uranium Utilization. R. L. Doan. *Mining Engineering*, v. 9, Sept. 1957, p. 1009-1112.

(A general, 17-57; U)

16-A. Beryllium. G. L. Miller. *Nuclear Power*, v. 2, Oct. 1957, p. 438-440.

Fabrication, properties and applications. 21 ref. (A general; Be)

17-A. Mag Moves Ahead. *Steel*, v. 141, Nov. 18, 1957, p. 192-203.

Excerpts from papers on casting, extrusion, welding, brazing and pressing presented at the Magnesium Association convention.
(A general; Mg)

18-A. (English.) **Production Problems of Titanium and Its Alloys. Pt. I.** R. L. P. Berry and E. Swainson. *Tidskrift for Kjemi, Bergvesen og Metallurgi*, v. 17, June 1957, p. 87-92. (CMA)

Effects of impurities, transformation, alloying and heat treating on the metallurgy of Ti, methods of reducing Ti, apparatus for melting it.
(A general; Ti)

19-A. (German.) **Development of Carbide Techniques in East Germany.** Curt Agt. *Neue Hütte*, v. 2, Sept. 1957, p. 537-544.

Tough, hard and wear resistant carbides; tantalum carbide; titanium carbide; technology, properties, cutting capacity, applications. 15 ref.
(A general; Ta, Ti, 6-69)

20-A. (German.) **Heat Resisting and Nonscaling Sintered Materials in Austria.** Friedrich Benesovsky and Richard Kieffer. *Neue Hütte*, v. 2, Sept. 1957, p. 545-554.

Titanium carbide, molybdenum silicide and boride-base materials; Mo and Mo alloys as high-temperature materials. 29 ref.
(A general, 2-12; Mo, 6-69, 6-70)

21-A. (German.) **Organization of Materials and Production in Management.** Werner Schütte, Ulrich Sabass, Hans-Heinrich von Lintig and Anton Schütz. *Stahl und Eisen*, v. 77, Aug. 22, 1957, p. 1146-1160.
(A5)

22-A. (Polish.) **Development of Transformer Steel.** M. Markuszewicz. *Hutnik*, v. 24, July-Aug. 1957, p. 258-266.

Grades of the transformer steel plate; izotropic plates; textured

plates; problems of plate utilization; products made in Poland. 56 ref. (A general; SGA-r, AY)

23-A. (Polish.) **Production and Magnetic Application of Soft Iron-Nickel Alloys in Soviet Union.** W. J. Skotnikow. *Hutnik,* v. 24, July-Aug. 1957, p. 282-289.

Classification of soft magnetic Fe-Ni alloys; technology of production process; uses, trends in Soviet research.
(A general, P16; Fe, Ni, SGA-n)

24-A. (Romanian.) **Recovery of Tellurium From Nonferrous Wastes.** R. Ripan, Gh. Marcu and N. Pascu. *Studii si Cercetari de Chimie,* v. 4, Jan-June 1956, p. 7-11.

Survey of products from the different phases of the Romanian nonferrous industry for recoverable Te. A new method for the preparation of Te by a wet process with acetic acid. (A11d; Te)

25-A. (Russian.) **New Grades of Low-Alloy Steel.** M. V. Pridantsev and G. L. Livshits. *Metallurg,* v. 2, July 1957, p. 18-19.

Chemical composition of 24 grades of low-alloy steel available in U.S.S.R.; advantages over carbon steel. (A general, S22; AY)

26-A. Impact of Automation. *American Machinist,* v. 101, Oct. 21, 1957, p. 166-180.

Reviews extent of automation in metalworking industry.
(A general, 18-74)

27-A. Boron Is a Toxicity Problem. W. H. Schechter. *Chemical and Engineering News,* v. 35, Dec. 2, 1957, p. 54-55.

(A7; B)

28-A.* Materials That Stand up When the Heat's On. J. Wambold and T. F. Frangos. *Design Engineering,* v. 3, Oct. 1957, p. 67-70.

Chemical composition; physical and mechanical properties of some cermets; processes of formation; sintering; densification of shape; applications. (A general; 6-70)

29-A. Cost Accounting Procedures for the Gray Iron Foundry. Pt. 2. Albert E. Grover. *Foundry,* v. 85, Dec. 1957, p. 94-97.

Procedures for handling plant assets. (A5, A4s; CI-n)

30-A. Electric Furnace Fumes Vacuum Cleaned to Prevent Air Pollution. *Industrial Heating,* v. 24, Sept. 1957, p. 1750-1754.

Electric furnace fumes and smoke are trapped by system of dacron bags and automatic dust collectors. (A8a, W17s)

31-A. What to Do About Metal Fires. *Iron Age,* v. 180, Nov. 21, 1957, p. 128-129.

(A7p)

32-A. Treatment and Re-Use of Mill Scale Wastes to Conserve Water and Abate Pollution. Grant A. Pettit. *Iron and Steel Engineer,* v. 34, Sept. 1957, p. 144-151.

Facilities and operation for treatment of mill scale wastes from roughing and finishing rolling mills. Sedimentation, flocculation, and clarifications system permits removal of 176,000 to 206,000 lb. of scale a day and recovery of water for reuse in mills and other processes.
(A8, W23)

33-A. The Steel Industry in India—Yesterday, Today and Tomorrow. E. T. Warren. *Iron and Steel Engineer,* v. 34, Nov. 1957, p. 80-89.

(A4; ST)

34-A.* High-Boron Alloy Steels. T. H. Middleham, J. R. Rait and E. W. Colbeck. *Iron and Steel Institute, Journal,* v. 187, Sept. 1957, p. 1-14.

Techniques for production of B-Al steels containing up to about 4.75% B which can be forged, rolled or extruded and production of B-Fe alloys with up to 6% B in form of castings; methods of manufacture, physical and mechanical properties, constitution and application of these B steels in thermal nuclear reactors. 23 ref. (A general, D general, Q general; AY, *Al, B*)

35-A. Raw Materials for the American Iron and Steel Industry. James C. O. Harris. *Journal of Metals,* v. 9, Dec. 1957, p. 1529-1532.

Steel consumption; pig iron requirements; iron ore supplies; beneficiated ore; coke requirements; scrap needs; effect of new steelmaking techniques; scrap substitutes. 11 ref.
(A4, D general; ST, Fe, RM-j43, RM-p, RM-n)

36-A. Science for Electroplaters. Pt. 30. Acidification of Cyanide Waste. L. Serota. *Metal Finishing,* v. 55, Nov. 1957, p. 72-75.

(A8b, L17)

37-A.* Research on Titanium. H. D. Kessler. *Metal Industry,* v. 91, Nov. 15, 1957, p. 415-417.

Determination of oxygen by means of the Pt bath vacuum fusion technique; solution treatment; formability and tensile properties.
(A general, S11, J27a, Q23q; Ti)

38-A.* Recent Statistics on Metallurgical Education. Michael B. Bever. *Metal Progress,* v. 72, Nov. 1957, p. 101-106.

While numbers of B.S. degrees in metallurgy do not now reach the postwar peak from G.I. training, the current number (545 in 1955-56) is a higher proportion of all engineering degrees. It is predicted that the figure will reach 750 in the near future and possibly 1000 within a few more years. M.S. degrees have been about 160 in each of the last three years. Ph.D. degrees show a steady increase from 42 in 1948-49, to 76 in 1955-56. (A3)

39-A. Tailings Disposal at Braden Copper Co. R. W. Jigins. *Mining Engineering,* v. 9, *AIME Transactions,* v. 208, Oct. 1957, p. 1135-1140.

Disposal of tailings from copper concentrater in Chile. (A8d; Cu)

40-A. Titanium and Zirconium, Twin Metals of the Atomic Age. K. C. Li. *Mining Engineering,* v. 9, Nov. 1957, p. 1245-1249. (CMA)

History, processing (by the Kroll, iodide, calcium hydride, electrolytic and Gross methods), cost and raw materials of Ti. 3 ref.
(A general, C general; Ti, Zr)

41-A. Metal Selector. *Steel,* v. 141, Oct. 28, 1957, p. 169-178.

Selection of proper metals for jobs considers composition, forming or casting properties, mechanical properties; application of wrought and cast Cu alloys, wrought and cast Al alloys, stainless steels, ferrous casting alloys, Zn die-casting alloys and Ti and Mg alloys. (A general; 17-57)

42-A. Summary of Existing Knowledge on the Zirconium-Uranium Alloys (10 to 50 w/o Uranium). W. L. Mudge, Jr. Westinghouse Atomic Power Division. *U. S. Atomic Energy Commission,* WAPD-MDM-20, Dec. 8, 1954, 19 p. (CMA)

Properties and fabrication. 23 ref.
(A general; Zr, U)

43-A.* Vacuum-Metallurgical Research Gives Industry a Glimpse Into the Future. R. C. Bertossa. *Welding Journal,* v. 36, Nov. 1957, p. 483s-489s.

Applications in designing process equipment for the chemical, petroleum, paper-pulp and aircraft industries. Role of vacuum in casting, purification, degassing, heat treatment, cladding, brazing, melting and joining. 6 ref. (A general, 1-73)

44-A. (Dutch.) **Review of the Behavior of Nickel Alloys, in Particular the Nickel-Chromium Alloys at High Temperature.** C. Vollers. *Metalen,* v. 12, Aug. 31, 1957, p. 302-310. (Pt. 1 in *Metalen,* v. 12, Sept. 15, 1957, p. 342-349.)

Characteristics of heat resistant Ni alloys, particularly Ni-Cr; fatigue, creep tensile properties, deformation, corrosion and weldability. Applications in gas turbines, motors, cast iron molds, extrusion tools, springs, nuts, bolts for high temperature, conveyors in annealing ovens, furnace parts. 19 ref.
(A general, 17-57; SGA-h, Ni, *Cr*)

45-A. (French.) **Present Uses and Possible Applications of Metal Molybdenum.** J. Fabry and P. Gousseland. *Documentation Métallurgique,* no. 27, July-Sept. 1956, p. 223-233. (CMA)

6 ref. (A general, 17-57; Mo)

46-A. (French.) **Influence of Aluminum Content of Zinc Alloys on Their Properties With Respect to Pressure Casting.** L. A. J. Lodder and K. P. Scott. *Fonderie,* no. 139, Aug. 1957, p. 367-377.

Influence of Al on structural, mechanical and chemical properties of Zamak alloys; economic importance; review of previous research. Intergranular corrosion of Zn-Al alloys; steam and atmosphere corrosion tests. 19 ref.
(A general, E13; Zn, *Al*)

47-A. (French.) **Foundry Productivity.** Guy de Ghellinck. *Fonderie Belge,* no. 10, Oct. 1957, p. 247-252.

Comparison of productivity of ten Belgian foundries. (A5, E general)

48-A. (French.) **Calculation of Heat Loss by Conduction in a Cowper.** D. Sanna. *Institut de Recherche de la Sidérurgie,* v. A, no. 129, Oct. 1957, p. 1-16.

(9 ref. (A11e, W17m)

49-A. (French.) **Industrial Grades of Ferronickel and Their Principal Applications.** Jean A. Ternisien. *Métallurgie et la Construction Mécanique,* v. 89, Oct. 1957, p. 817-827.

(To be continued.) (A general, 17-57; Fe, Ni)

50-A. (German.) **Cast Iron With Spheroidal Graphite.** A. Hohmann. *Giesserei Praxis,* v. 75, Oct. 10, 1957, p. 436-437.

Definition; production; properties; advantages. (A general; CI-v)

51-A.* (German.) **Furnace Slag for Road Ballast.** Paul Huttemann. *Stahl und Eisen,* v. 77, Oct. 1957, p. 1436-1442.

Testing methods for strain on road building materials; comparison between natural rock and slag; relationship between chemical composition and mineralogical structure and elastic and plastic properties; determination of crushing degree; effect on properties of different structures. 6 ref. (A11c; RM-q)

52-A. (Italian.) **Iron. Pt. 2. Steel. Pt. 3. Recent Trends in Steelmaking.** Marco Savarese and Andrea Ciaccio.

Industria Mineraria, v. 8, Aug. 1957, p. 545-560.

Historical review; recent trends in ore preparation and in manufacture of iron and steel; direct production of iron. (To be continued.)
(A2, D general; ST, CI)

53-A. (Norwegian.) **Deposits of Chromium Ore East of Roros.** Rolf Falck-Muus. *Tidsskrift for Kjemi, Bergvesen og Metallurgi,* v. 17, no. 5, 1957, p. 73-76.

Mineralogical description. Finds of peridotite minerals (e.g., olivine, enstatite, chromite, uwarowite, magnesite, talcum, and others such as serpentine and asbestos).
(A11a; Cr, RM-n)

54-A. (Book.) **Uranium in South Africa, 1946-1956.** 1029 p. 1957. Associated Scientific and Technical Societies of South Africa, P. O. Box 5907, Johannesburg, South Africa. $20.

(A general; U)

55-A. (Book.) **Making, Shaping, and Treating of Steel.** 732 p. 1957. 7th Edition. United States Steel Corp., Office Service-Stores, 525 William Penn Place, Pittsburgh 30, Pa. $7.50.

Comprehensive summary of present-day theory and practice covering all phases of iron and steel production from raw materials to finished products. (A general; ST)

56-A. (Book.) **First Nuclear Engineering and Science Congress, Selected Papers.** 2 v., 643 p. 1957. Pergamon Press, 122 East 55th St., New York 22, N. Y.

Covers U ores, U alloys and reactor materials. Papers of interest not previously covered as preprints abstracted separately.
(A general, W11p, 17-57; U)

B Ore and Raw Material Preparation

1-B. Some General Chemical Principles in Extraction of Metals From Low-Grade Ores. A. J. E. Welch. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 1-14.

Review of a number of recent processes in which chemical concentration methods are predominantly applied to low-grade ores; general pattern of such processes; unit-process steps needing more fundamental study. 24 ref.
(B14, C19; RM-n)

2-B. Chemical and Physical Concentration of Uranium Ores. S. W. F. Patching. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 107-118.

22 ref. (B13, B14; U, RM-n)

3-B. Pilot Plant Concentration of Mindola Uranium Ore. M. L. Fitzgerald and D. F. Kelsall. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 163-174.

Removal of carbonates by a straight grinding and flotation circuit, with provision for the incorporation of gravity scalping.
(B13, B14h; U, RM-n)

4-B. Flotation of Vanadium Ore From the Abenab West Mine of the South West Africa Co. M. G. Fleming. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 212-257. (CMA)

The ores are vanadinite and descloizite in a gangue of ferruginous clay, iron oxides, dolomite, calcite and quartz; 40% is finer than 200 mesh. Xanthates were chosen as collectors. Xanthate concentration, relative flotability of minerals, and sodium carbonate concentration.
(B14h, V, RM-n)

5-B. (Russian.) **Automation of Several Aggregates in a Sintering Plant.** I. M. Ravikovich. *Stal',* v. 17, May 1957, p. 385-388. (Translation in *Iron and Coal Trades Review,* v. 175, Aug. 9, 1957, p. 323-325.)

Automation assures even distribution of the charge among the various units while constant height of the burden is maintained. If the chute clogs or belt breaks the conveyor is stopped and a device protects the conveyor belt from hot returns.
(B16a, 1-52, W12r; Fe, RM-n)

6-B. (Russian.) **Treatment of High-Silicon Ores in Rotary Kilns.** V. Kyuncher and I. Shleier. *Stal',* v. 17, May 1957, p. 392-401.

Low-grade acidic ores may be treated more economically in rotary kilns than by roasting-magnetic or wet mechanical methods of beneficiation; ores with a definite free silica content can be worked at a lower cost than in low-stack furnaces. 5 ref.
(B15, W15a, 1-52; Fe, *Si,* RM-n)

7-B. (Russian.) **Effect of Mineralogical Composition of Molybdenum Concentrates on the Roasting Process.** T. P. Khazanova, N. P. Lyakishev and E. A. Grishankova. *Stal',* v. 17, May 1957, p. 425-429.

It is expedient to add missing mineralogical constituents to molybdenum concentrates to bring them up to standard requirements for obtaining uniform results in roasting. The minerals considered are calcite, chalcopyrite, quartz, galena, feldspar, hematite.
(B15; Mo, RM-n, NM-e)

8-B. Dry Magnetic Concentration. P. E. Cavanagh and E. W. Williams. *Canadian Mining and Metallurgical Bulletin,* v. 50, Sept. 1957, p. 558-564. (Also, *Transactions,* v. 50, 1957, p. 326-332.)

Results of pilot-plant study on concentration of magnetite iron ore in a dry state by means of magnetic concentrators. (B14j; Fe, RM-n)

9-B. Exploration and Development of the Sedimentary Iron Ores of Missouri. William C. Hayes. *Information Circular No. 14.* State of Missouri, Dept. of Business and Administration, Division of Geological Survey and Water Resources. 1957, p. 1-33.

15 ref. (B general; Fe, RM-n)

10-B. Lime Addition and Pulp Consistency in Gold Ore Milling. G. Chad Norris. *Institution of Mining and Metallurgy, Bulletin,* no. 610, Sept. 1957, p. 597-611.

Addition of lime to process in form of milk-of-lime prepared by slaking quicklime with excess water resulted in more efficient use of lime and smoother ball-mill and classifier operation than intermittent addition of lime as quicklime ahead of grinding mills. Milk-of-lime additions are preferably made at several points in process, each appropriate to next stage, in ore treatment. 9 ref.
(B13c; Au, RM-8)

11-B. Uranium Ore Processing. Richard H. Kennedy. *Mines Magazine,* v. 47, Sept. 1957, p. 22-25, 38.

(B14; U, RM-n)

12-B. Consolidated Denison Mines, Ltd. *Mines Magazine,* v. 47, Sept. 1957, p. 63-64.

Uranium mining at Quirke Lake, Northern Ontario. (B12; U)

13-B. Innovations in Processing Uranium Ores. J. B. Rosenbaum, W. L. Lennemann and J. B. Clemmer. *Mining Engineering,* v. 9, Sept. 1957, p. 976-981.

Beneficiation by attrition grinding and lime flotation. Flow sheets on U extraction, including solvent extraction of sulphuric acid eluate, char-in-pulp system, pressure oxidation leaching, hydrogen precipitation from soda ash solution, thick slurry solvent extraction, ammonium carbonate leaching and nonaqueous extraction. 6 ref.
(B13, B14, C19; U, RM-n)

14-B. (German.) **Application of New Flocculants for the Improvement of the Clarification and Filtering of German Ores.** Martin Clement. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 10, Sept. 1957, p. 421-427.

Besides organic and inorganic electrolytes, highly polymeric substances such as Separan, Aerofloc and DT 120 were found to be advantageous for clarifying and filtering ores as well as for faster coagulation and sedimentation. 12 ref. (B14q; RM-n)

15-B. (German.) **Agglomeration of Iron Ore Fines in Vacuum Extrusion Presses.** Manfred Häuser. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 10, Sept. 1957, p. 443-450.

A series of experiments were carried out on a particularly difficult bog iron ore, with the object of obtaining satisfactory lump sizes. Various additions such as cement, limestone and coke breeze were tested.
(B14; Fe, RM-n)

16-B. Portfolio of Flowsheets. *Canadian Mining Manual,* 1957, p. 149-207.

Flowsheets covering Au, Ag, Ag-C, Fe ore, base metals, U processes at various Canadian mines.
(B13, B14, B15)

17-B. Selected Annotated Bibliography of Thorium and Rare-Earth Deposits in the United States Including Alaska. K. L. Buck. *U. S. Atomic Energy Commission,* GSB-1019-F, 1957, 28 p. (CMA)

(B general; Th, EG-g)

18-B. Concentration of Beach Sand Minerals From Ballina, N. S. W. S. G. Hudson. *Australia. Commonwealth Scientific and Industrial Research Organization. Ore-Dressing Investigations with Mining Department, University of Melbourne, Report 526,* Mar. 1957, 9 p. (CMA)

(B14; Ti)

19-B. (German.) **Production of Burden Briquettes Without Binders From Ore, Brown Coal or Basic Fluxes.** Wilhelm Petersen and Siegfried Wawroschek. *Stahl und Eisen,* v. 77, Oct. 1957, p. 1427-1435.

Economic importance and state of development of low-temperature smelting. 18 ref.
(B16d, C21; RM-j, RM-h, RM-q)

20-B. (Rumanian.) **Extraction of Titanium Dioxide From Red Sludges Remaining From the Manufacture of Aluminum.** C. G. Macarovici, L. Czeglady, H. Roth and I. Soos. *Studii si Cercetari Stiintifice, Seria 1. Stiinte Matematice, Fizice, Chimice si Tehnice,* v. 6, July-Dec. 1955, p. 87-109. (CMA)

The best yields (60-70%) of a product containing 80% TiO_2 were obtained by the hydrolytical treatment

of sludges with a mixture of $HClO_4$ and HCl. 122 ref. (B14; Ti)

21-B. (Russian.) **Melting Point of Molybdenite.** A. N. Zelikman and L. V. Belyaevskaya. *Zhurnal Neorganicheskoi Khimii,* v. 1, no. 10, Oct. 1956, p. 2239-2244. (CMA)

4 ref. (B geenral, P12n; Mo)

22-B. (Russian.) **Study of the Reaction of Oxidation of Molybdenite.** A. N. Zelikman and L. V. Belyaevskaya. *Zhurnal Neorganicheskoi Khimii,* v. 1, Oct. 1956, p. 2245-2256. (CMA)

Concentrates of molybdenum ores prepared by oxidizing molybdenite (MoS_2) to molybdenum trioxide (MoS_3). 4 ref. (B14; Mo)

23-B. (Pamphlet.) **Some Investigations on the Preparation and Properties of Metallic Slurry Systems With Particular Reference to Particle Behavior.** G. W. Greenwood and B. Sharpe. Atomic Energy Research Establishment M/R 2250, 1957, 28 p. 5 sh.

34 ref. (B14)

C Extraction and Refining

1-C. Solvent Extraction Separation of Uranium and Plutonium From Fission Products. F. L. Culler and J. R. Flanary. *First Nuclear Engineering and Science Congress,* v. 2, 1957, p. 84-87.

A solution of tri-*n*-butyl in refined kerosene extracts uranium (VI) and plutonium (IV) from a nitric acid solution of irradiated uranium, leaving the bulk of the fission products in the aqueous phase. (C19; U, Pu)

2-C. Processing of Irradiated Thorium. A. T. Gresky. *First Nuclear Engineering and Science Congress,* v. 2, 1957, p. 88-95.

A method for processing the thorium blanket of a thermal breeder reactor recovers more than 99% of the thorium and U^{233} and separates them from each other and fission products by a factor of 10,000. (C28, A11p; Th, U)

3-C. Uranium Processing Using Uranium Hexafluoride. Herbert H. Hyman, Irving Sheft and Joseph J. Katz. *First Nuclear Engineering and Science Congress,* v. 2, 1957, p. 144-149.

Bromine trifluoride may be used in the preparation of uranium hexafluoride from fuel elements, ore concentrates or waste slags; dissolution and decontamination procedures. (C1p; U)

4-C. Extraction of Protactinium From Solid Thorium Fluoride. R. H. Wiswall, Jr., R. J. Heus and F. T. Miles. *First Nuclear Engineering and Science Congress,* v. 2, 1957, p. 164-169.

Removal of protactinium tracer from thorium fluoride powder by treatment with gaseous fluorine. Kinetics analyzed in terms of a solid-state diffusion process accompanied by a slow change in the properties of the solid. (C1p; Pa)

5-C. Melting and Fabrication of Binary Alloys of Uranium With Molybdenum, Niobium and Silicon. F. R. Lorenz, W. B. Haynes, E. S. Foster. *First Nuclear Engineering and Science Congress,* v. 1, 1957, p. 176-185.

Vacuum induction melting and consumable electrode arc melting combined into a duplex melting technique producing sound, homogeneous alloy ingots of about 50 lb.; furnaces and accessories used. Working by extrusion, forging, rolling and swaging. (C5h, C5j, 1-73, F general; U, *Mo, Cb, Si*)

6-C. Method for the Production of Titanium-Aluminum Alloys by Reduction of Titanium Oxide. L. F. Mondolfo and A. Roy. *Light Metal Age,* v. 15, Oct. 1957, p. 11-16.

Alloy is treated with Mg or a Mg-Zn alloy to leach out the excess Al until a Ti-Al alloy of low aluminum content is obtained. Distillation removes the leaching reagent. (To be continued.) (C19n; Ti, Al)

7-C. Operation of a Pulse Column for the Production of Hafnium-Free Zirconium. J. B. Robinson and H. T. Tupper. *U. S. Atomic Energy Commission,* KT-70, May 26, 1950, 13 p. (CMA)

Hafnium thiocyanate complexes were extracted in the course of producing hafnium-free zirconium by liquid-liquid extraction at the Y-12 plant. An unpacked column 60 ft. high was considered inconvenient so a pilot study was made to shorten it. Data on the effect of pulse frequency and through-put are tabulated. (C19; Zr, Hf)

8-C. Filtration of Thiocyanic Acid Condensation Products in the Zirconium-Hafnium Separation Plant. G. R. Jansy and H. T. Tupper. *U. S. Atomic Energy Commission,* KT-71, June 20, 1950, 10 p. (CMA)

To remove the solid condensates forming at the interfaces of extraction and scrubbing towers for the thiocyanate separation of hafnium from zirconium, a filter press was used with a choice of two filter aids. Effectiveness of the system was determined by the percentage of solids removed; diatomaceous earth is the better filter aid. (C19p, 1-52; Zr, Hf)

9-C. Induction Melting Process for Titanium Scrap. P. J. Ahearn and C. F. Frey. U. S. Watertown Arsenal, Report 10/12. *U. S. Office of Technical Services,* PB 131241, Apr. 1957, 11 p. (CMA)

A number of 20 to 25-lb. Ti ingots were prepared from Ti-6Al-4V scrap. The heats were melted in a high-frequency induction furnace under an inert atmosphere. Contamination by the graphite crucible was minimized by use of a titanium skull in the bottom of the crucible. (C5j; Ti, RM-p)

10-C. Purification by Solvent Extraction. J. M. Fletcher. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 15-33.

Three types of solvent extraction; the merits of solvent extraction compared with those of other methods; particular examples using tributyl phosphate as the organic solvent. 11 ref. (C19; RM-n)

11-C. Studies in the Chlorination of Some Complex Ores—Wolframite, Vanadinite and Chromite. E. A. Pokorny. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 34-48.

The use of varying mixtures of chlorine and hydrogen added another variant—the dissociation of the chlorides and oxy-chlorides—thus increasing the scope of chlorination and in some circumstances leading to a certain selectivity of the action of chlorine. (C19r; W, V, Cr, RM-n)

12-C. An Oxide-Chloride Conversion Process for the Extraction of Certain Metals. A. R. Gibson and J. H. Buddery. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 49-71.

A method whereby some metallic oxides may be converted to chlorides in solution in alkali or alkaline earth chlorides. A fluid melt substantially oxygen-free is generated, from which metal may be precipitated and recovered. Chemical actions involved and theory based on experiments with uranium dioxide and thoria. 5 ref. (C19r; U)

13-C. Metallurgical Developments in the Recovery of Some of the Less Common Metals in Canada. L. E. Djingheuzian. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 72-95.

Columbium, tantalum, lithium, selenium and tellurium. 28 ref. (C general; Cb, Ta, Li, Se, Te)

14-C. Extraction of Some Less Common Metals From Smelter and Refinery Intermediates at La Oroya, Peru (Selenium, Tellurium and Thallium). W. E. Koeppel and A. K. Schellinger. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 96-106.

Recovery of Se and Te from anode residue plant cupel dusts and slags under high-altitude conditions. Thallium from lead blast furnace fume traced through the cadmium plant circuit; extraction from leach solutions. Production of high-purity thallium from dichromate precipitate. (C21; Se, Te, Tl)

15-C. Recovery of Uranium From Sulphate Leach Solutions by Anion Exchange. T. V. Arden. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 119-142.

Precipitation methods proposed or tested; modern ion exchange plants. 14 ref. (C19s; U)

16-C. Factors Influencing the Magnesium Reduction of Uranium Tetrafluoride. J. Harper and A. E. Williams. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 143-162.

Experimental work for up to 5 kg. uranium. Side reactions which can influence the efficiency of the process and the quality of the metal billet. A technique which gives a high-density uranium billet. 4 ref. (C26; U)

17-C. Processes for the Extraction of Vanadium. C. Tyzack and P. G. England. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 175-195. (CMA)

Two methods studied: In one, ferrovanadium is chlorinated to VCl_4, which was separated from the other impurity chlorides, decomposed to VCl_3 and reduced by hydrogen to VCl_2; hydrogen reduction to vanadium by a fluid bed technique. The other method is the calcium reduction of the oxides under inert atmosphere. Iodine or sulphur is used as a booster. The calcium system has the greatest economic advantage. 4 ref. (C19r, C26; V)

18-C. Production of High-Purity Vanadium Metal. E. Foley, M. Ward and A. L. Hock. Paper from "Extraction and Refining of the Rarer

Metals," Institution of Mining and Metallurgy, 1957, p. 196-211. (CMA)

Theory suggests that magnesium reduction of a suitable vanadium chloride should be a sound basis for producing the metal. Ferrovanadium is chlorinated to VCl_4, decomposed in refluxing to VCl_3, and reduced in argon at 850° C. Byproducts and excess reductant are distilled off under argon and vacuum. The sponge produced is 99.7% V. 70 ref. (C26; V-a, 6-74)

19-C. Selection of Process for Development for the Production of Pure Niobium. G. K. Dickson and J. A. Dukes. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 258-271.

The chemistry of five separate processes and relative costs. (C general; Cb-a)

20-C. Extraction of Pure Niobium by a Chlorination Process. A. B. McIntosh and J. S. Broadley. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 272-286.

New process for extracting pure Cb from its ores or ferrocolumbium by chlorination and hydrogen reduction. Separation of Ta from Cb on a pilot-plant scale by preferential hydrogen reduction of the mixed Cb and Ta pentachloride. (C19r; Cb, Ta)

21-C. Distillation of Volatile Chlorides as a Means of Obtaining Pure Niobium. B. R. Steele and D. Geldart. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 287-309.

Separation of Cb from Ta, W and Fe by fractionation of their volatile chlorides is a convenient means of obtaining pure Cb which could easily be developed to a plant scale. Equipment and theory. (C22; Cb)

22-C. Beryllium Production at Milford Haven. P. S. Bryant. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 310-322.

Stages of the process from conditioning of the ore to purification of the hydroxide and recovery of beryllium from effluent liquors and slurries. Production of hydroxide-carbon briquettes and crude beryllium chloride and its purification; electrolysis of fused chloride and leaching of the cathode deposit. (C23; Be)

23-C. Preparation of Beryllium Metal by Thermal Reduction of the Fluoride. L. J. Derham and D. A. Temple. Paper from "Extraction and Refining of the Rarer Metals," Institution of Metals, 1957, p. 323-336.

Beryllium hydroxide is reacted with ammonium bifluoride and ammonium fluoberyllate is crystallized out by evaporation. The crystals are then decomposed in a graphite retort at 850° C. Ammonium fluoride is sublimed from the retort, beryllium fluoride being tapped as a molten anhydrous glass into graphite molds. The beryllium fluoride is crushed, mixed with high-purity magnesium and reduced in a graphite crucible at 900° C. The charge is heated to above 1283° C., cooled and the melted beryllium separated. 20 ref. (C1p; Be)

24-C. Purification of Metals by Intermediate Formation of Their Stable Halide Vapours With Application to Beryllium and Titanium. P. Gross and D. L. Levi. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 337-350.

Metals of which vapor pressures are too low for their evaporation at practicable temperatures may be distilled by a reversible endothermic reaction; conditions of the reactions and factors influencing purity of the distillate. Beryllium and titanium as examples. 4 ref. (C22h; Be, Ti)

25-C. Extraction of Thorium From Monazite. A. Audsley, R. Lind and P. G. England. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 351-380.

Purification processes based on chlorination and on solvent extraction of concentrates prepared from the rock by sulphuric acid breakdown. The products of these purification processes are then reduced to metal by calcium. 19 ref. (C19r, C26; Th, RM-n)

26-C. Some Investigations Into the Extraction of Titanium by Fused Salt Electrolysis. F. L. Bett, et al. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 381-401. (CMA)

Electrolysis of titanium chlorides in fused salts. $TiCl_3$ may be prepared separately or in the electrolyte; use of soluble anodes; electrolytic cell design. 17 ref. (C23n, 1-52; Ti)

27-C. The Manufacture of Hafnium-Free Zirconium. F. Hudswell and J. M. Hutcheon. Paper from "Extraction and Refining of the Rarer Metals," Institution of Mining and Metallurgy, 1957, p. 402-419. (CMA)

Separation methods, including fractional crystallization of potassium fluorozirconate and fluorohafnate, vapor-phase dechlorination, fractional distillation of alkoxides, chromatography on paper pulp or silica gel, cationic or anionic exchange, and liquid-liquid with TBP and with methyl isobutyl ketone and HCNS. 22 ref. (C28; Zr)

28-C. Treatment of Auriferous Roasted Product From Victorian Antimony Mines, Costerfield, Victoria. J. T. Woodcock. Commonwealth of Australia, Commonwealth Scientific and Industrial Research Organization and the Mining Department, University of Melbourne, Ore Dressing Investigations Report No. 524, Feb. 1957, 24 p.

An antimony-gold ore assaying 8 dwt. per ton Au, 8% Sb, and 1% S was investigated after special roasting treatment. Best extraction of Au obtained was by direct amalgamation in absence of lime, with recovery up to 40%. Less satisfactory results were obtained by amalgamation in presence of lime, direct cyanidation, fine grinding plus agitation, cyanidation with pre-aeration or prior alkali leaching, flotation. 6 ref. (C29, C19, B14; Au, RM-n)

29-C. Treatment of Auriferous Battery Tailings From Black Cameron Mine, Queenstown, Victoria. J. T. Woodcock. Commonwealth of Australia, Commonwealth Scientific and Industrial Research Organization and the Mining Department, University of Melbourne, Ore Dressing Investigations Report No. 525, Feb. 1957, 6 p.

Sample of tailings studied contained 2.75 dwt. per ton gold and a little pyrite. No coarse gold was present and amalgamation recovered very little gold. Direct cyanidation extracted 66%; extraction could be increased to 79% by regrinding to 66% finer than 200 mesh. (C19p, C29; Au)

30-C. (Italian.) Zone Melting Method for Refining of Metals. T. Federighi. *Alluminio*, v. 26, Sept. 1957, p. 361-366.

Principles and practical considerations, including shape of specimen, length of melted zone, number of zones, rate and method of travel of zone or heat source, heating methods, specimen carriers, floating-zone technique, atmosphere. Extension of technique to homogenization and study of eutectics in complex phase diagrams; possible uses of superpure metals; zone melting as an aid to study of physical and mechanical properties of metals. 35 ref. (C28k, M24)

31-C. Separation of Zirconium and Hafnium By Differential Reduction of Their Tetrachlorides. I. E. Newnham. *American Chemical Society, Journal*, v. 79, Oct. 1957, p. 5415-5417. (CMA) (C28; Zr, Hf)

32-C. Continuous Cold Trap for Fluoride Volatility Processing of Uranium. J. C. Bresee and P. R. Larson. *Industrial and Engineering Chemistry*, v. 49, Sept. 1957, p. 1349-1354.

Enriched uranium is recovered from heterogeneous reactor fuel by low-pressure volatility process using fluidized continuous condenser. 9 ref. (C22; U)

33-C. Vacuum Dezincing of Parkes' Process Zinc Crusts. V. F. Leferrer. *Journal of Metals*, v. 9, *AIME Transactions*, v. 209, Nov. 1957, p. 1459-1460. (C28, 1-73; Zn, *Pb, Ag*)

34-C. Cominco Operations. John Grinrod. *Mine and Quarry Engineering*, v. 23, Oct. 1957, p. 432-439.

Activities of the Consolidated Mining and Smelting Co. of Canada Ltd. (C general, B general; Pb, Zn)

35-C. Uranium Recovery by Continuous Countercurrent Ion Exchange. E. L. Rau. *Mines Magazine*, v. 47, Sept. 1957, p. 39-41, 59. (C19s; U)

36-C. Columnar Ion Exchange—Resin-in-Pulp — Solvent Extraction. Colorado School of Mines Research Foundation Inc. *Mining Engineering*, v. 9, Sept. 1957, p. 973.

Methods of recovering U. (C19; U)

37-C. Recent Trends in Extracting Uranium. Frederick B. Brien. *Mining Engineering*, v. 9, Sept. 1957, p. 974-975.

Preconcentration, leaching, solution purification, solution concentration, precipitation and analysis. 14 ref. (C19, B14; U)

38-C. Atmospheric Versus Pressure Leaching of Uranium Ores. R. G. Beverly, A. W. Griffith and W. A. Millsap. *Mining Engineering*, v. 9, Sept. 1957, p. 982-988.

Chemistry and flow sheet of hot sodium carbonate, sodium bicarbonate extraction; uranium-bearing solution separated from solid residue by filtration and uranium precipitated from solutions. Data from pilot plant study on effect of pressures and temperatures on percentage extraction and leach time. 10 ref. (C19; U, RM-n)

39-C. Ammonium Carbonate Pressure Leaching of Uranium Ores. B. G. Langston, R. D. Macdonald and

F. M. Stephens, Jr. *Mining Engineering*, v. 9, Sept. 1957, p. 989-993.

Leaching conditions; chemistry of process; effect of temperature, pressure, oxidation, ammonium carbonate and bicarbonate concentration; advantages compared to sodium carbonate leaching. (C19n; U, RM-n)

40-C. Solvent Extraction of Uranium at Shiprock, N. M. W. C. Hazen and A. V. Henrickson. *Mining Engineering*, v. 9, Sept. 1957, p. 994-996.

Circuit and operation of plant utilizing di-2-ethyl hexyl phosphoric acid and tributyl phosphate dissolved in kerosene to extract U from acid leach liquor; uranium-laden solvent stripped with sodium carbonate solutions and carbonate solutions acidified and uranium precipitated with ammonia or magnesia. (C19; U)

41-C. Solvent Extraction. Newcomer to the Colorado Plateau. A. M. Ross. *Mining Engineering*, v. 9, Sept. 1957, p. 997-1000.

Advantages of solvent extraction for recovering U from acid leach solution; alkyl amines compared to alkyl phosphates. 12 ref. (C19; U)

42-C. Continuous Countercurrent Ion Exchange in Hydrometallurgical Separators. Clement K. Chase. *Mining Engineering*, v. 9, Sept. 1957, p. 1001-1003.

Advantages in using continuous countercurrent resin slurry operation for extraction of uranium from alkaline or acid leach liquors. (C19s; U)

43-C. Recovery of Uranium From Lignites. Edward S. Porter and Henry G. Petrow. *Mining Engineering*, v. 9, Sept. 1957, p. 1004-1006.

Pilot plant study of roasting, leaching and solvent extraction. 6 ref. (C19, B15; U, RM-n)

44-C.* Subaquatic Casting of Aluminum Ingots. Ichiji Obinata and Hiroshi Tanaka. *American Society for Metals, Transactions*, v. 51, Preprint no. 67, 1957, 23 p.

Method of making ingots by casting molten Al and its alloys in thin-walled metal molds set in hot water (SAC process). Sound ingots of fine and homogeneous equiaxed structure are obtained. While there exists no marked difference between SAC and chill ingots in the physical and chemical properties, the mechanical properties of the former are somewhat superior to those of the latter. 7 ref. (C5; Al, 5-59)

45-C.* Isolation and Separation of Niobium and Tantalum Pentoxides From Mineral Concentrates by Liquid-Liquid Extraction. G. H. Faye and W. R. Inman. *Canadian Mining and Metallurgical Bulletin*, v. 50, Oct. 1957, p. 606-613. (Also, *Transactions*, v. 60, 1957, p. 343-347.)

Methods successfully used on laboratory scale for recovery of Cb and Ta, pentoxides from concentrates of Canadian pyrochlore ores containing 3 to 20% Cb oxide and small amounts of Ta. Method uses hydrochloric nitric acid mixture for acid decomposition and extraction by means of methyl isobutyl ketone. 6 ref. (C19; Cb, Ta)

46-C.* Contribution of Ion Exchange to Nuclear Technology. L. D. Roland. *Chemical and Process Engineering*, v. 38, Sept. 1957, p. 367-371.

Description of process and explanation of chemistry of ion exchange; operation of a 3-column U extraction plant, of a resin-in-pulp extraction system; nuclear reactor water treatment methods, waste disposal technique; ion exchange process of separation of Hf from Zr and types of disposal plants. (C19s, A8b; Zr, Hf)

47-C.* Refractories and Mould Materials for Vacuum Melting and Casting. H. O. McIntire. *Foundry Trade Journal*, v. 103, Nov. 7, 1957, p. 543-548.

Alloys that benefit particularly by vacuum melting include the Ni-base alloys (which contain appreciable amounts of Al and Ti), high-alumina iron-base alloys such as Thermenol, and certain grades of steel where the greatest possible freedom from nonmetallic inclusions is needed. Considerable success has been achieved with refractories commonly used for melting and casting in air at normal pressures. 6 ref. (C25, D8m, 1-73; RM-h, Ni, ST)

48-C.* Removal of Lead From Copper in Fire Refining. J. E. Stolarczyk, A. Cibula, P. Gregory and R. W. Ruddle. *Institute of Metals, Journal*, v. 86, Oct. 1957, p. 49-58.

New phosphate treatment in which additions of phosphor-copper are made to the oxidized copper melt in the ratio of two parts of phosphor to one part of lead to be removed. Pb is precipitated in the melt as globules of Cu-Pb phosphate which quickly rise to the surface of the bath. 9 ref. (C21; Pb, Cu, RM-q)

49-C.* Removal of Lead and Tin From Copper in Fire Refining. J. E. Stolarczyk and R. W. Ruddle. *Institute of Metals, Journal*, v. 86, Oct. 1957, p. 59-64.

Slags composed of silica, iron oxide and phosphorus pentoxide were efficient. Slag consisting of 70% sodium carbonate and 30% calcium oxide efficiently removed low (0.02%) concentrations of tin. Best conditions for the use of this slag. 4 ref. (C21; Cu, Pb, Sn, RM-q)

50-C. Low-Cost Method Strengthens Iron Ore Pellets. *Iron Age*, v. 180, Nov. 21, 1957, p. 130-131. (B16b; Fe, RM-n, 6-67)

51-C.* Preparation of Uranium Metal by Fused Salt Electrolysis. G. Meister and W. C. Lilliendahl. *Journal of Metals*, v. 9, *AIME Transactions*, v. 209, Nov. 1957, p. 1445-1447.

Uranium metal with a purity of about 99.9% was produced on a large scale by fused salt electrolysis with a material efficiency of about 90%. Efficiency depends mainly on bath composition, electrolysis temperature, electrode smothering and elutriation during washing of the powder. 5 ref. (C23; U)

52-C. Method for the Production of Titanium-Aluminum Alloys by Reduction of Titanium Oxide. L. F. Mondolfo and A. Roy. *Light Metal Age*, v. 15, Oct. 1957, p. 11-12, 14, 16. (CMA)

IIT method of producing Ti-Al alloys by reducing TiO_2 with Al. (C26; Ti, Al)

53-C.* Direct Chill Casting of Large Aluminum Ingots. A. T. Taylor, D. H. Thompson and J. J. Wegner. *Metal Progress*, v. 72, Nov. 1957, p. 70-74.

Interrupted quenching is incorporated in the D. C. process to produce sound castings in sizes large enough to provide billets for huge forging and extrusion presses. A simple air blast device interrupts the flow of quenching water. (C5, N12; Al, 5-59)

54-C.* Production of Zinc in a Blast Furnace. S. W. K. Morgan. *Metallurgia*, v. 56, Sept. 1957, p. 115-120.

Process for smelting Zn whereby furnace gases which contain 5 to 6% Zn and 8 to 10% CO_2 are brought into contact with shower of molten Pb which condenses 89% Zn vapor allowing recovery as metal; remaining 11% recovered as dross from condenser; process useful for smelting Pb-Zn concentrates as well as high-grade Zn concentrates; Pb recovered as bullion. 13 ref. (C21a; Zn, Pb)

55-C.* Effect of Roasting on Recovery of Uranium and Vanadium From Carnotite Ores by Carbonate Leaching. J. Halpern, F. A. Forward and A. H. Ross. *Mining Engineering*, 9, *AIME Transactions*, v. 208, Oct. 1957, p. 1129-1134.

Chemical aspects and effect of prior roasting procedures on recovery. 8 ref. (C19n, B15; U, V)

56-C. Zirconium for Nuclear Reactors. I. E. Newnham. *Research*, v. 10, Nov. 1957, p. 424-428. (CMA)

A new hafnium separation method is proposed on the basis of a differential reducibility of the tetrachlorides of the metals. (C19r, T11q, 17-57; Zr)

57-C. Non-Aqueous Processing—an Introduction. S. Lawroski. Paper from "Symposium on Reprocessing of Irradiated Fuels." Book 2. *U. S. Atomic Energy Commission*, TID-7534, p. 479-497.

General discussion on fluoride volatility and pyrometallurgical processes. 8 ref. (C21, C22, A11d, T11g)

58-C. Fluoride Volatility Processes for Low Alloy Fuels. R. C. Vogel and R. K. Steunenberg. Paper from "Symposium on Reprocessing of Irradiated Fuels." Book 2. *U. S. Atomic Energy Commission*, TID-7534, p. 498-559.

Application of processes to irradiated fuel elements consisting of natural or slightly enriched U-containing fission products and Pu of recoverable amounts. Blanket materials in the future may be of a similar nature. 11 ref. (C22, A11d, T11q; U, Pu)

59-C. Fluoride Volatility Process for High Alloy Fuels. G. I. Cathers. Paper from "Symposium on Reprocessing of Irradiated Fuels." Book 2. *U. S. Atomic Energy Commission*, TID-7534, p. 560-575.

Development work on the fused salt fluoride volatility process being carried out at Argonne and Oak Ridge National Laboratories. Covers fused salt dissolution and fluorination work in addition to sodium fluoride absorption as a proposed new technique for decontaminating and handling the product UF_6. (C22, A11d, T11q; U)

60-C. Engineering and Economic Considerations of Volatility Processes. Pt. 1. Engineering. R. W. Kessie, S. Lawroski, M. Levenson, R. C. Lumatainen, W. J. Mecham, W. A. Rodger, W. B. Seefeldt, G. J. Vogel and G. E. Goring. Paper from "Symposium on Reprocessing of Irradiated Fuels." Book 2. *U. S. Atomic Energy Commission*, TID-7534, p. 576-612.

Corrosion is the predominant consideration in selecting materials;

summarizes corrosion studies on the environments of the various process operations. (C22, R general, T11g)

61-C. Engineering and Economic Considerations of Volatility Processes. Pt. 2. Economics. O. J. DuTemple, W. J. Mecham and G. J. Vogel. Paper from "Symposium on Reprocessing of Irradiated Fuels." Book 2. *U. S. Atomic Energy Commission,* TID-7534, p. 613-666.

Comparison with existing solvent processes. 32 ref. (C22, A11d, T11g)

62-C. Chemistry of Pyrometallurgical Processes: A Review. Harold M. Feder. Paper from "Symposium on Reprocessing of Irradiated Fuels." Book 2. *U. S. Atomic Energy Commission,* TID-7534, p. 667-718.

Separation of U, Pu, Th, fission elements or other unwanted elements from each other in whatever combination they may occur and to whatever extent is required in connection with neutron reaction technology. 77 ref.
(C21, A11d, T11g; U, Pu, Th)

63-C. Pyrometallurgical Process; Process and Equipment Development. E. Motta, D. Sinizer, G. Brand, J. Foltz, W. Gardner, J. Ballif, J. Guon, G. Kendall, T. Luebben and K. Mattern. Paper from "Symposium on Reprocessing of Irradiated Fuels." Book 2. *U. S. Atomic Energy Commission,* TID-7534, p. 710-747.

Various furnaces for extracting fission products or Pu from molten fuel; systems related to the refabrication into fuel elements of the partially decontaminated and reconstituted fuel alloys. 3 ref. (C21, 1-52, A11d, T11g)

64-C. Pyrometallurgical Processing: Economics and Proposed Engineering Applications. J. H. Schraidt, W. A. Rodger, M. Levenson, S. Lawroski, D. C. Hampson, J. Graae, L. F. Coleman, L. Burris, Jr., G. J. Bernstein and G. A. Bennett. Paper from "Symposium on Reprocessing of Irradiated Fuels." Book 2. *U. S. Atomic Energy Commission,* TID-7534, p. 748-804.

Savings are expected by reduction of fuel inventory through rapid processing, use of simple, compact processes requiring no chemical conversion, recovery of expensive alloying agents, and simplification of waste disposal and criticality problems. 27 ref. (C21, A11d, T11g)

65-C. (French.) **Preparation of Zirconium and of Some Zirconium Alloys by Fused Salt Electrolysis.** Jean-Lucien Andrieux and Jeanne Dauphin. *Comptes Rendus,* v. 245, Oct. 21, 1957, p. 1359-1362. (CMA)

Only electrolytes containing $CaCl_2$ and alkali chloride such as KCl or NaCl gave zirconium in a spongelike form. 12 ref. (C23; Zr)

66-C. (French.) **Manufacture of Light Alloys Plates for Stamping.** Martial Renouard and Yves Bresson. *Revue de l'Aluminium,* no. 246, Sept. 1957, p. 833-841.

A minimum isotropy is required in plates used in stamping processes. Semicontinuous casting brings about preferential orientations in the slabs. Annealing gives the required isotropy for Al-Mn alloys. With usual Al alloys, either the semi-continuous casting process must be modified or a homogenization treatment used. (C5, G3; Al, *Mn*)

67-C. (Russian.) **Iodide Method for Refining Zirconium.** G. I. Stepanova and F. I. Busol. *Atomnaya Energiya,* v. 3, Oct. 1957, p. 344-346. (CMA)
4 ref. (C1p; Zr)

68-C. (Russian.) **Separation of Titanium From Columbium With the Aid of Cationites.** S. I. Solov'ev, E. I. Krylov and L. P. Kononova. *Zhurnal Neorganicheskoi Khimii,* v. 1, Apr. 1956, p. 660-663. (CMA)
13 ref. (C19; Ti, Cb)

69-C. (Russian.) **Interaction of Oxides of Neodymium and Lanthanum With Chlorine Gas.** *Zhurnal Neorganicheskoi Khimii,* v. 1, no. 11, Nov. 1957, p. 2606-2612. (CMA)

Importance of chlorination in metallurgical separations; some of the thermodynamic characteristics of the chlorination reaction of solid neodymium and lanthanum oxides. Equilibrium constants and changes of free energy determined. 5 ref. (C19r, P12; Nd, La)

70-C. (Book.) **Symposium on Reprocessing of Irradiated Fuels, Held at Brussels, Belgium, May 20-25, 1957, Book 2. Non-Aqueous Processing.** *U. S. Atomic Energy Commission,* TID-7534, 804 p.

Papers abstracted separately.
(C general, A11d, T11g)

71-C. (Book.) **Symposium on Extraction Metallurgy of Some of the Less Common Metals Arranged by the Institution of Mining and Metallurgy, Held on Mar. 22-23, 1956.** 1957. 444 p. Institution of Mining and Metallurgy, 44 Portland Place, London, W. 1, England.

Papers abstracted separately.
(C general)

D Iron and Steelmaking

1-D. (Russian.) **Use of Oxygen in a 250-Ton Openhearth Furnace.** S. I. Lifshits and I. F. Sochan. *Stal',* v. 17, May 1957, p. 402-405.

Effectiveness of the furnace can be increased demonstrably by introducing oxygen into the furnace through the burner during charging, heating and pouring of the molten metal. Oxygen is injected into the bath by a Laval nozzle.
(D2g, W18g, 1-52; ST)

2-D. (Russian.) **Influence of Ultrasonics on the Structure and Properties of Steel Ingots.** Ya. B. Gurevich, V. I. Leontiev and I. I. Teumin. *Stal',* v. 17, May 1957, p. 406-411. (Also available as Henry Brutcher Translation No. 4035.)

By experimentally subjecting molten steel to the action of ultrasonic waves during the process of crystallization the macro and the microstructures, as well as the physical properties of the ingot can be considerably improved. 11 ref.
(D9, 1-74; ST, 5-59)

3-D. Iscor Works, Vanderbijl Park, South Africa. *Blast Furnace and Steel Plant,* v. 45, Nov. 1957, p. 1270-1292.
(D general; ST)

4-D. By-Passing the Blast Furnace. The U. S. A. Streamlines Direct Reduction to Meet Coking Coal Shortage. Edmund L. Van Devsen. *Engineer and Foundryman,* v. 22, Aug. 1957, p. 36-39.
(D8j; Fe)

5-D. Blast-Furnace Practice Using Sinter Burdens. Results at Appleby-Frodingham Steel Co. H. S. Ayres. *Iron and Coal Trades Review,* v. 175, Sept. 13, 1957, p. 601-604.

Practice and results. (D1a, Fe)

6-D. The 48th BISRA Steelmaking Conference. Pt. I. Increasing Open-Hearth Productivity by Modernization of Older Plants. *Iron and Coal Trades Review,* v. 175, Sept. 13, 1957, p. 621-624.

Report of first session of conference held May 8-9, 1957. (D2, 1-52)

7-D. Submerged Arc Pig-Iron Production. W. Bleloch. *Mining and Industrial Review,* v. 101, Aug. 1957, p. 20-22.

An alternative to the blast furnace. (D8n, CI-a)

8-D. (German.) **Melting of Transformer Steel.** Kurt Fellcht and Helmut Kutscher. *Neue Hütte,* v. 2, Sept. 1957, p. 525-537.

Influence of C, Si, Mn, P, S, Cu, Al, Cr, W, Ni, V, Mo, Ti, H, N, O; physical and technical properties; eddy current loss values; utilization of a 75 and a 90% ferrosilicon during melting. 17 ref.
(D general, 2-60; SGA-r, AY)

9-D. (Polish.) **Problems of Transformer Steel Refining.** M. Stankiewicz. *Hutnik,* v. 24, July-Aug. 1957, p. 266-271.

Chemical composition and influence of the elements upon magnetic properties of the steel. Problem of nonmetallic inclusions of ferrosilicon type. Refining in electric and openhearth furnaces.
(D2, D5, P16, 2-60; SGA-r, AY)

10-D. (Polish.) **Technology of Transformer Steel Refining in U.S.S.R.** G. M. Borodulin. *Hutnik,* v. 24, July-Aug. 1957, p. 272-277.

Chemical composition; preparation of the furnace; charging raw materials; oxidation period; reduction period; finishing of the melt; vacuum treatment of the metal.
(D2; SGA-r, AY)

11-D. (Russian.) **Operation of Blast Furnace With Increased Gas Pressure.** I. A. Kuzmin. *Metallurg,* v. 2, July 1957, p. 3-5.

Savings in coke consumption; overall output increase with substantial increase of slag output. (D1h; Fe)

12-D. (Russian.) **Efficiency of Oxygen Application in Steel Smelting.** V. A. Rozhkov. *Metallurg,* v. 2, July 1957, p. 12-15.

Openhearth furnace operation using oxygen. Steel output was increased by 8-10%. (D2g; ST)

13-D. (Russian.) **New Technology of Stainless Steel Melting.** B. A. Shilyaev. *Metallurg,* v. 2, July 1957, p. 20-21.

New process giving Cr losses below 12%; lining life increased by 50-100%. (D general; SS)

14-D. Vacuum Treatment of Molten Metal. *Foundry Trade Journal,* v. 103, Oct. 31, 1957, p. 527-529.

Russian experiments on bessemer and electric steels.
(D8m, ST-f, ST-g)

15-D.* Vacuum Melting in the Steel Industry Today. W. W. Dyrkacz. *Journal of Metals,* v. 9, Dec. 1957, p. 1513-1516.

Advantages and disadvantages of induction vacuum melting and consumable-electrode vacuum arc melting. Typical applications of each process. 32 ref. (D8m; ST)

16-D.* Ladle Slag-Refining of Electric Furnace Steel. Rene Perrin and F. Weston Starratt. *Journal of Metals,* v. 9, Dec. 1957, p. 1517-1520.

Rapid desulphurization and deoxidation practice at the Ugine plant. Metal is tapped from the furnace into a ladle containing slag especial-

METALLURGICAL RESEARCH AT 1500°C

development of high

To obtain purer, high quality metals to direct nuclear reactor application, metallurgists at Bettis Atomic Power Division are investigating the fundamentals of the reactions that take place between liquid metals, the gaseous atmosphere, and the crucible materials. Techniques, which have been used in both the iron and steel and non-ferrous industries, are now being applied at Bettis for study of the uranium base alloys.

Dr. Earl H. Roland, Senior Engineer, has set up a melting system in which small quantities of fuel alloys are melted under vacuum in the order of 10^{-5} mm Hg and under controlled gaseous atmospheres.

The following problems are typical: (1) Gas-liquid metal equilibria, and the effects of composition on gas-metal equilibrium; (2) deoxidation of uranium alloys; (3) measurement of chemical activities in uranium alloys; (4) zone refining; (5) directional solidification; and (6) the solubility of carbon in liquid uranium-niobium alloys.

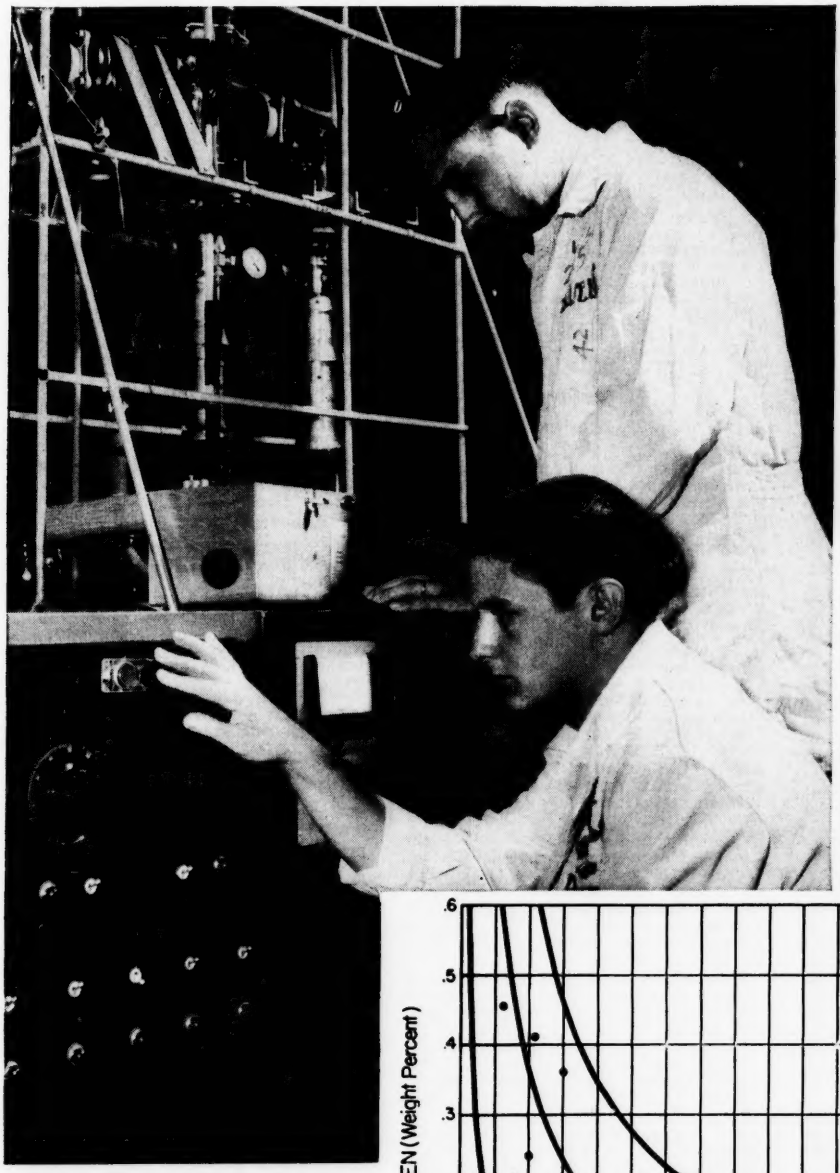
To give a specific example, Dr. Roland vacuum-melted a uranium-niobium alloy and held it for various lengths of time at 1550°C, 1650°C and 1750°C in a uranium dioxide crucible to study the carbon-oxygen equilibrium in a liquid U-Nb alloy. The initial carbon-oxygen values come from impurities in the charge materials. The melts are analyzed for carbon and oxygen. Those values are then compared with a theoretical relationship derived from thermodynamic considerations. The results are shown in the graph on this page. Note the agreement between experiment and theoretical prediction.

The changes in the impurity content, which are experienced during the melting, can be attributed to the fact that the impurities tend toward equilibrium with the crucible materials and the furnace atmosphere.

A better understanding of equilibrium conditions will permit the specification of furnace practices to control the impurity levels and thus improve nuclear fuels.

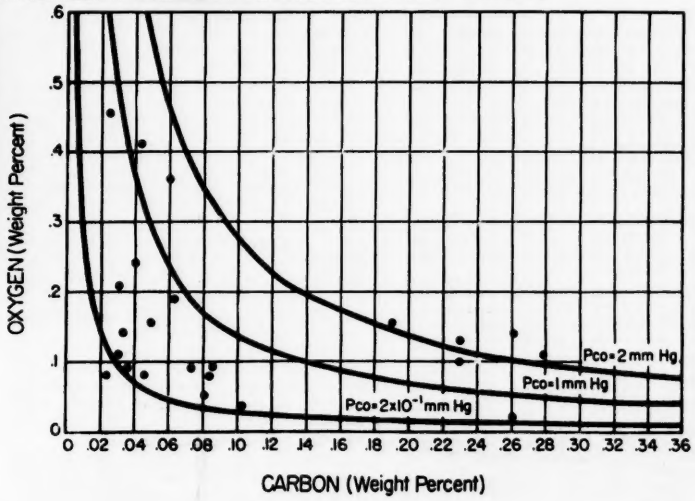
This is only one example of the challenging work conducted here. We welcome inquiries from metallurgists interested in the excellent careers offered by the new and growing nuclear power industry. Please send your resume to: Mr. M. J. Downey, Dept. #M-1, Bettis Atomic Power Division, Westinghouse Electric Corporation, P.O. Box 1468, Pittsburgh 30, Pa.

purity nuclear fuels



Dr. Earl H. Roland (Carnegie Institute of Technology '56) and Philip Patterson (Case Institute of Technology '56), metallurgists at Bettis Atomic Power Division, are shown as they record temperature and CO pressure for the determination of carbon-oxygen equilibrium in a uranium base alloy.

Carbon-oxygen equilibrium relationship in a uranium base alloy at 1750°C.



ly made to accomplish these processes. Other slags have been developed to reduce the P and Si contents of killed and rimming steels and to desiliconize and desulphurize iron. (D11n, D11r, D5; ST)

17-D.* An Oxygen Steelmaking Process. F. W. Luerssen, J. W. Halley and M. Tenenbaum. *Journal of Metals,* v. 9, *AIME Transactions,* v. 209, Dec. 1957, p. 1533-1540.

High-carbon low-phosphorus steel can now be made from pig iron containing 0.7% P or more, in a commercial sized openhearth furnace. No external heat is required for refining and steel produced is identical with basic openhearth steel. 14 ref. (D10; ST)

18-D.* Origin and Elimination of Hydrogen in Basic Open-Hearth Steels. W. L. Kerlie and J. H. Richards. *Journal of Metals,* v. 9, *AIME Transactions,* v. 209, Dec. 1957, p. 1541-1548.

The variation in hydrogen content of basic openhearth steels during refining and the effect of changing from steam to air atomization. The water content of the furnace atmosphere, the slag basicity, and the degree of oxidation of the slag-metal system largely control the hydrogen in the steel. 7 ref. (D11; ST-e, *H*)

19-D. Vacuum Melted Steel. Commercial Scale Production in Sheffield. *Metallurgia,* v. 36, Nov. 1957, p. 237-238.

At G. L. Willan Ltd. (D8m; ST)

20-D. (Czech.) **Economy of Remelting Czechoslovak Ren-Process Balls in Blast, Low-Shaft, Reverberatory and Cupola Furnaces.** Alexander Dékanovsky. *Hutnické Listy,* v. 12, 1957, p. 673-682.

Surveys and compares methods. Resulting intermediate product is bessemer pig iron or reverberatory iron and cupola furnace iron. Treatment of balls in blast furnaces proved most effective. 33 ref. (D general, W17, W18; Fe)

21-D. (Czech.) **Importance of Vacuum Steel Casting for Metallurgical Practice.** Zdenek Eminger, Frantisek Kinsky and Zdenek Kletecka. *Hutnické Listy,* v. 12, 1957, p. 755-767.

Only method employed at present consists of vacuum casting followed by cooling under normal atmospheric pressure. Vacuum casting shortens production time and gives closer control of mechanical properties. (D9, 1-73; ST)

22-D.* (German.) **Rimming Steel.** Leo Heinen and Alfred Latour. *Stahl und Eisen,* v. 77, Sept. 1957, p. 1204-1209.

Variables affecting yield of rimming type free-cutting steel include melting practice and indirect effect of oxygen in the heat, direct effect of oxygen, C, Mn, S content, Mn:S ratio, pouring conditions and S segregation. (D9p, 2-60; ST-d, *Mn, S*)

23-D.* (German.) **Production of High-Quality Rimmed Steel.** Herman Schenck. *Stahl und Eisen,* v. 77, Oct. 1957, p. 1442-1450.

Extent of slag forming reactions, influence of slag change; appearance and removal of oxygen dissolved in the molten steel, useful effect of higher oxygen content; ultimate effect on the slag; activity of ferrous oxide in the mixing of slags. 16 ref. (D2, D11n, ST-d)

24-D. (German.) **Control of Bessemer Converters by Spectral Analysis of the Smoke.** Franz Wever, Walter Koch, Hans Lüdering, Helmut Knüppel, Karl Ernst Mayer, Bernd Alexander Steinkopf and Gert Wiethoff. *Stahl und Eisen,* v. 77, Oct. 1957, p. 1451-1459.

Sampling at the converter; interpretation of the spectrometer curve on the basis of optical characteristics of the converter flame and of the converter smoke; analysis of the smoke and relationship of its formation with metallurgical reactions. 17 ref. (D3, S11k)

25-D. (Russian.) **New Types of Solid Solution in High-Titanium Slags.** A. V. Rudneva, M. S. Model' and T. Ya. Malysheva. *Akademiya Nauk S.S.S.R. Doklady,* v. 115, July 1, 1957, p. 141-144. (CMA)

Minerals of the rutile type, MgO-TiO_2, FeO-TiO_2 and MnO-TiO_2, forming among them and with Ti_2O_3 continuous series of solid solutions miscible in all proportions. 7 ref. (D11n; Ti, Mg, Mn, RM-q)

26-D. (Russian.) **Melting of Killed Carbon Steel Previously Unreduced in the Open Hearth Furnace.** A. I. Borodulin. *Metallurg,* v. 2, July 1957, p. 16-17.

Experimental melting of rail steel without previous reduction in the openhearth furnace. Savings in ferromanganese consumption were 30-100%. (D8; CN; *Mn*)

E Foundry

1-E. New Chevrolet Plant Diecasts Transmission Parts. Kenneth L. Mountain. *Foundry,* v. 85, Nov. 1957, p. 93-97.

(E13)

2-E. Vibration Can Improve Casting Quality. A. H. Freedman, J. F. Wallace and F. A. Carbonaro. *Foundry,* v. 85, Nov. 1957, p. 98-99.

Vibration has beneficial effects in degassing molten metals, grain refinement of solidifying metals and improvement in the detail of castings by an increase in the "apparent fluidity". 9 ref. (E25)

3-E. Close Control Required to Produce Aircraft and Missile Castings. William G. Gude. *Foundry,* v. 85, Nov. 1957, p. 102-105.

Steel foundry practice at Pacific Alloy Engineering Corp., El Cajon, Calif. (E general, T24, 17-57; ST)

4-E. Stainless and Heat-Resistant Investment Castings. R. Taylor. *Foundry Trade Journal,* v. 103, Oct. 24, 1957, p. 483-494.

Precision casting at Firth-Vickers Ltd., Sheffield. Dies, production of wax patterns, soluble wax technique, assembly of patterns, primary investment, boxing, secondary investment, mold drying, dewaxing, firing and casting, effect of alloy composition. (E15; SS, SGA-h)

5-E. Three Foundries in the Irish Republic. V. C. Faulkner. *Foundry Trade Journal,* v. 103, Oct. 24, 1957, p. 497-498.

Hammond Lane, I.V.I. and Tonge and Taggert Foundries. (E general, 1-52)

6-E. (German.) **Development and Operation of the Hot Blast Cupola Furnace.** Ernst Löbbecke. *Giesserei,* v. 44, Aug. 29, 1957, p. 505-515.

Design of a hot blast cupola; operation of acid hot blast cupolas; hot blast cupolas without linings. 46 ref. (E10a, W18d, 1-52)

7-E. (German.) **Practical Suggestions for Application of Pouring Gates of Exothermic Material in the Steel Foundry.** Karl Reinmann. *Giesserei,* v. 44, Sept. 12, 1957, p. 550-552.

Design of the exothermic gates; savings realized by use of exothermic gates. 16 ref. (E22p, 1-52; ST)

8-E. (German.) **Olivine, a Fireproof Molding Sand.** *Giesserei-Praxis,* v. 75, Sept. 10, 1957, p. 376-378.

History, properties, chemical composition, occurrence, industrial uses, data related to other fireproof materials, advantages as mold, proper mixtures. 2 ref. (E18)

9-E. (German.) **Defects of Overhardened Cast Iron.** Hans Reininger. *Giesserei-Praxis,* v. 75, Sept. 30, 1957, p. 389-394.

Occurrence; characteristics, causes, prevention. (E11; CI, 9)

10-E. (Japanese.) **Studies on Aluminum-Magnesium Casting Alloys.** Masao Kato and Yasuji Nakamura. *University of Tokyo, Report of the Institute of Industrial Science,* Ser. 48, v. 6, Mar. 1957, 49 p.

Causes and remedies for difficulties in manufacturing processes. (E general; Al, *Mg*)

11-E. A Guide to South African Foundry Mechanisation. H. Godwin. *Engineer and Foundryman,* v. 22, Aug. 1957, p. 44-50.

Examples of mechanization in sand preparation, storage and distribution, molding and casting. (E11, 18-74)

12-E. (German.) **Sweden's Foundry Industry.** Lars Villner. *Giesserei,* v. 44, Oct. 10, 1957, p. 631-636.

(E general)

13-E. (German.) **Melting of Plain Carbon Steel for Castings in Low-Frequency Induction Crucible Furnaces.** Heinz Rohn. *Giesserei,* v. 44, Oct. 24, 1957, p. 662-665.

Comparison with conventional melting units; metallurgy and economics involved. 5 ref. (E10r, W18a; ST)

14-E. (German.) **Calculation of the Riser-Neck on Sand Castings.** Richard Namur. *Giesserei,* v. 44, Oct. 24, 1957, p. 665-671.

(E22q)

15-E. (German.) **Selection of Alloys for Die Casting.** W. Wolf. *Metall,* v. 11, Aug. 1957, p. 655-659.

The founder wants suitability for casting while the user looks for good mechanical properties, high accuracy and good surface finish. Zn, Al and Cu alloys constitute a compromise. (E13; Zn, Al, Cu)

16-E. (Russian.) **Alloying and Modification of Heat Resisting Silicon Cast Iron.** P. I. Durasov and N. N. Aleksandrov. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 42-48.

All samples showed tendency to develop cracks except Si iron with spheroidal graphite alloyed with Mn. 8 ref. (E21; CI-r, *Si*)

17-E. (Russian.) **Horizontal, Centrifugal Casting Machine.** E. M. Petrov and M. T. Evdokimov. *Vestnik Mashinostroeniya,* v. 37, Aug. 1957, p. 33-36.

Design and characteristics of new machine which can handle castings 1000 mm. in diameter, 3500 mm. long and 10-100 mm. thick. (E14, 1-52)

18-E. How Precision Toolmaking Affects Shell-Molding Success. Otto W. Winter. *American Machinist,* v. 101, Oct. 21, 1957, p. 139-142.

Special precautions in the cooling of patterns and core boxes for shell

molding to counteract thermal effects, mold spreading, collapse or distortion and to provide for gating and stripping. (E19c)

19-E.* Effect of Aluminium on the Inoculating Power of Ferrosilicon and Its Tendency to Give Pinholing. J. V. Dawson. *British Cast Iron Research Association Journal of Research and Development,* v. 7, Aug. 1957, p. 2-9.

Effects of varying amounts of Al in ferrosilicon used as an inoculant in nodular graphite cast iron; effects of Al content on inoculating power, pinholing, mechanical properties and eutectic cell count. (E25q; AD-h, AD-p36, Fe, Si, Al, CI-r)

20-E.* Preliminary Study of the Mode of Solidification of Chill Test Casting. I. C. H. Hughes. *British Cast Iron Research Association, Journal of Research and Development,* v. 7, Aug. 1957, p. 10-22.

Theoretical aspects of chill and mottle formation for sand and chill test castings; analysis of cooling curves and temperature distributions in solidifying cast iron. Effects of pouring temperature upon chill; formation of mottle and the characteristics of chill test fracture. 6 ref. (E22r, E25n; CI)

21-E.* A Note on the Influence of Furnace Holding Time on Chill and Mottle Formation. J. Rickard. *British Cast Iron Research Association, Journal of Research and Development,* v. 7, Aug. 1957, p. 23-26.

Effects of pouring temperature, superheating temperature and furnace holding time on the depth of chill and mottle in chilled cast iron. (E22r; CI)

22-E.* Application of Sodium Silicates for Bonding Sands. F. W. Nield and D. Epstein. *British Foundryman,* v. 50, Sept. 1957, p. 457-465.

Bond produced by passing carbon dioxide through test pieces of silicate sand containing as bonding agents sodium silicate with ratio of silicon dioxide to sodium oxide of 2.0, 2.5, 2.9 or 3.3; relationships between compression strength and gassing time, temperature and bonding solids. 4 ref. (E18n)

23-E.* Improvements in Surface Finish, Inspection, and Fettling of Grey-Iron Castings. L. Clarke. *British Foundryman,* v. 50, Nov. 1957, p. 539-551.

Design, patterns, sands, gating additions, washes, shot-blasting and controlled heat treatment; inspection of castings, gaging, hardness testing, crack detection and gamma ray tests; reduced fettling, standard gating and feeding methods. (E11, S general; CI-n)

24-E.* Some Observations on Cupola Tapping. F. D. Roper. *British Foundryman,* v. 50, Nov. 1957, p. 553-556.

Operations entailed in intermittent tapping from cupolas. The tap-hole; its preparation, size, material used; shape of the tap-hole and its influence on actual tapping operations. Botting materials and the technique of botting-up. (E10a, 1-52)

25-E. Operating Experience With a Hot-Blast Cupola Plant. J. J. Sheehan and G. J. Shaw. *British Foundryman,* v. 50, Nov. 1957, p. 556-562.

Design of plant; recuperator, instrumentation; principles of operation; operating performance; melting rate; metal control; cork and fluxes; metal structure and labor requirements. (E10a, W18d)

26-E.* Effect of Design Variables Upon Shrinkage Defects Under Bosses on Thin Plates. A. G. Fuller. *British Cast Iron Research Association, Journal of Research and Development,* v. 7, Oct. 1957, p. 54-67.

Effect of variation in plate thickness, boss size, "gating ratio", and the position of the sprue relative to the casting, upon sinking beneath bosses on thin plates. Results on the basis of metal flow and temperature conditions within the casting. Sinking increases when conditions are such that the heat content of the metal filling the mold is increased. 8 ref. (E22; CI)

27-E.* Inverse Greyness in Malleable Cast Iron. C. T. Moore. *British Cast Iron Research Association, Journal of Research and Development,* v. 15, Dec. 1957, p. 68-79.

Preliminary investigation of inverse grayness occurring in certain types of commercially produced blackheart malleable castings, factors affecting the incidence of this defect in thin sections attached to a relatively heavier section of a test casting. Inverse grayness was found to increase simultaneously with mottle in the heavy section when the Al, Si, C or Mn content was increased. High casting temperatures and an increase in the thickness of the thin section also aggravated the defect. 3 ref. (E25q; CI-s)

28-E.* Carbon Pick-Up in the Cupola. Michael Perch and Charles C. Russell. *Foundry,* v. 85, Dec. 1957, p. 70-75.

Ash content of coke, or its major constituent, Si, has a significant inhibiting effect on C solubility in Fe. The type of Fe also seems to be important to the amount of C pick-up. 10 ref. (E10a; RM-j43)

29-E. Mold-Metal Interface Reactions. Howard F. Taylor and José Navarro. *Foundry,* v. 85, Dec. 1957, p. 76-80.

Theory for interface control which is basic enough to explain observed phenomena in the fields of investment casting, conventional sand mold processes and metal oxidation. 10 ref. (E11, E15, E19, M27F)

30-E.* Shrinkage in Tin Bronze Castings. Clyde L. Frear. *Foundry,* v. 85, Dec. 1957, p. 81-85.

Behavior of Sn bronzes; causes of defects such as cavities, shrinkage and leakages; solidification characteristics; types of dendrites, formation. 3 ref. (To be continued.) (E25n; Cu-s, *Sn,* 9-68)

31-E.* How to Make Epoxy Patterns and Coreboxes. Joseph W. Tierney. *Foundry,* v. 85, Dec. 1957, p. 86-90.

Epoxy plastic tooling technique is a duplicating process. The mold usually is of plaster or of epoxy material, made from a pattern or model of the part. From this mold, many epoxy patterns or coreboxes can be made in a fraction of time otherwise required to make a duplicate pattern. (E17, E21; NM-d)

32-E. "Slagging" of Cupolas. *Foundry Trade Journal,* v. 103, Oct. 31, 1957, p. 513-515.

Slag handling and disposal. (E10a; RM-q)

33-E. Czech Foundry Developments. Further Research in CO_2 Practice. *Foundry Trade Journal,* v. 103, Oct. 31, 1957, p. 518-520.

Abstracts of three articles contained in a booklet entitled "Progressive Methods in the Foundry" issued by the Czech Research Institute for Materials and Technology. (E18)

34-E.* Plaster Moulding of Beryllium Bronze. Louis Grand. *Foundry Trade Journal,* v. 103, Nov. 14, 1957, p. 573-576.

Benefits desired from substituting plaster for molding sand are improved surface finish, enabling the impression to be polished without machining and filing, and an increase in the fineness of pattern detail due to the low thermal conductivity of plaster. (E16a; Cu, *Be*)

35-E. Systematic Control Guides Production of High Quality Gray Iron Castings. A. W. Schneble. *Industrial Heating,* v. 24, Sept. 1957, p. 1860-1872.

Sand preparation and handling; control in molding and coremaking, melting practice control. (E11, E18; CI-n)

36-E. Manufacture and Use of Large Aluminum Die Castings. D. A. Bauer. *Machinery (London),* v. 91, Sept. 27, 1957, p. 757-762.

(E13; Al, ST)

37-E. Design of Die-Castings. Pt. 4. Determination of Tolerances. H. K. Barton. *Metal Industry,* v. 91, Nov. 15, 1957, p. 419, 424.

(E13, 17-51)

38-E. Cast Titanium and Zirconium Parts. S. M. Shelton. *Precision Metal Molding,* v. 15, Nov. 1957, p. 48-49, 110-112. (CMA)

Castings are most successfully produced by consumable electrode vacuum melting and pouring into graphite molds. (E12, E10r; Ti, Zr, 5-63)

39-E. Investment Caster Uses Vacuum. *Steel,* v. 141, Nov. 25, 1957, p. 96-98.

Austenal Inc. uses Ni-base alloys for gas turbine blades on production line operation. (E15, 1-73; Ni)

40-E. Casts 150 Engine Blocks an Hour. *Steel,* v. 141, Dec. 2, 1957, p. 122-124.

Automated line at Pontiac's foundry built around two indexable molding machines. (E19, 1-52, 1-61; ST)

41-E. (Dutch.) **Visit to the Foundry Institutes in Denmark, Sweden and Norway.** Gieterij Centrum. *Gieterij-Centrum Berichten,* v. 5, Sept. 1957, p. 49-52.

Exchange of ideas and comparison of operational conditions. Comparative production figures, including Finland (which was not visited). The Technological Institute in Copenhagen has a training foundry supported by the industry. The Metal Institute in Stockholm pays much attention to synthetic sand. The Foundry Section of the Technological Institute in Oslo is in the beginning stage. (E general, A9)

42-E. (French.) **Core Racks.** J. Léonard. *La Fonderie Belge,* no. 10, Oct. 1957, p. 242-246.

List of defects caused by wrong arrangement of cores or by ignorance of properties of core racks; mechanical tests on racks. (E-21, W19g)

43-E. (German.) **Foundry Sand Testing.** Jules Kistler. *Giesserei Praxis,* v. 75, Oct. 10, 1957, p. 429-435.

Purpose; permeability; fineness; mechanical and physical properties; fire resistance; moisture content. (E18)

44-E. (Japanese.) **Gases in Cast Iron.** S. Ikeda, H. Iwanaga and Y. Ono. *Casting Institute of Japan, Journal,* v. 29, July 1957, p. 499-507.

Casting defects due to nitrogen in molten Fe; effect of $K_3Fe(Cn)6$, Fe_2O_3, SiO, Fe-Si and Al in molten iron. (E11; CI, *Si, Al*)

45-E. (Japanese.) **Influence of Height of Test Piece on Properties of Molding Sands.** Kenji Hashimoto. *Casting Institute of Japan, Journal,* v. 29, July 1957, p. 522-527.

Permeability is not influenced by the height, top hardness increases linearly; ramming energy necessary to mold a test piece increases proportionally by height, and compression strength is inversely proportional to height. (E18r)

46-E. (Japanese.) **Semi-Continuous Casting of Aluminum.** Shigeo Muromachi. *Light Metals,* v. 7, July 1957, p. 6-27.

Fundamental experiments on segregation in Al alloys; studies on semicontinuous casting. 45 ref. (E25n, C5q; Al)

47-E. (Japanese.) **Shrinkage Coefficent and Deformation of Die and Gravity Castings. Pt. 7.** Tomonobu Kanno and Torazo Uehara. *Light Metals,* v. 7, July 1957, p. 69-74.

Formula for production of castings with desired shape. (E13, E11, E25q; 5-61)

48-E. (Book-French.) **Metals and Process Alloys Used in Ferrous Metal Casting.** Prepared by Centre Technique des Industries de la Fonderie (Foundry Industries' Scientific Center). 106 p. 1957. Editions Techniques des Industries de la Fonderie, 12 Av. Raphael, Paris, (16e) France. 1800 F.

Handbook for founders. Principal metals and their applications, reasons for use of alloys, alloying equipment. Lists of French suppliers of raw materials for ferrous metal foundries. Appendix covers standard specifications used in U. S., chemical analyses, fusion ranges and densities of ferro-alloys, physical properties of principal metals, chapter on pearlite, characteristic diagrams. (E general; ST, CI)

F Primary Mechanical Working

1-F. Diamond Wire Drawing Dies. *Metal Industry,* v. 91, Oct. 25, 1957, p. 353-357.

Investigation into the performance of English and foreign dies. (To be continued.) (F28, W24n, 1-52; NM-k 37)

2-F. (German.) **Computation of the Mean Deformation Resistance and of the Rolling Pressure Arising at Cold and Hot Rolling of Square Rods and Sheets.** A. Geleji. *Acta Technica,* v. 18, no. 1-2, 1957, p. 77-100.

Method for computing deformation resistance of hot and cold rolling; formulas and tables. (F23)

3-F. (Russian.) **Rolling of Rails With a Profile Groove in Blooming Mill Rolls.** N. I. Beda, G. P. Borisenko and M. P. Galemin. *Stal',* v. 17, May 1957, p. 431-435.

Using the fourth pass in blooming mill rolls for rail profiles where the split is staggered results in higher rate and a minimum of scrap due to fine cracks. 5 ref. (F23, W23a, 1-52, T23q; ST)

4-F. (Russian.) **Experimental Determination of Stresses During Rolling.** V. N. Poturaev. *Stal',* v. 17, May 1957, p. 438-440.

Results obtained aid designers of equipment to calculate more accurately the requirements for new technological processes in which metal is deformed under pressure. (F2, F23, 17-51)

5-F. Industrial Diamonds in the Wire Mill. L. A. Zucker. *Industrial Diamond Review,* v. 17, Sept. 1957, p. 173-175, 179.

Practice at Union Wire Die Corp. (F28; 1-2, NM-k37)

6-F. Continuous Rolling: Fundamentals of Design and Calculation of Roll Speed. Z. Wusatowski. *Iron and Steel,* v. 30, Nov. 1957, p. 609-610, 617. (F23, 1-61, 17-51)

7-F. Diamond Wire Drawing Dies (Concluded). *Metal Industry,* v. 91, Nov. 1, 1957, p. 379-381.

Mountings, die contours, die characteristics, X-ray examination. (F28, W24n; NM-k37)

8-F. Heavy Flanged Forgings Fully Formed With Split Die. *Metalworking,* v. 8, Nov. 1957, p. 10-11.

Split-die method used for pipe fittings of high-pressure oil and gas wells gives fully formed forgings to precise dimensions with grain flow that gives the greatest strength. (F22, T6a; ST)

9-F. Welded Structure Improved by Forging. W. Wollering and E. Lundby. *SAE Journal,* v. 65, Oct. 1957, p. 122, 125. (F22; 7-51)

10-F. (German.) **Problems in the Drive and Control of Straight Multiple Wiredrawing Machines.** F. Liekmeier. *Draht,* v. 8, Aug. 1957, p. 282-285.

Control of the drive units is governed by the drawing force and a counterforce originating in the next following drum. The variable speed of drums can be obtained through differential gears, through a-c. and d-c. motors in different arrangements and with electronic devices. (F28, 1-52)

11-F. (German.) **Production of Copper Wire.** H. D. Feldman. *Draht,* v. 8, Aug. 1957, p. 310-312.

Change in tensile strength after various forming processes and heat treatments; pressing, washing, welding and drawing ratios influence the properties of the final product. Defects have their cause in the foundry or in the drawing process. 7 ref. (F28; Cu)

12-F. (German.) **Cold Rolling.** Werner Lueg and Paul Funke, Jr. *Stahl und Eisen,* v. 77, Oct. 3, 1957, p. 1356-1362.

Calculation of the effect of rolling speed on the rolling effort and strip thickness. 9 ref. (F23, 3-67)

13-F. (German.) **Lubricants and Steel Wire Drawing. Pt. 3.** Winfrid Dahl and Werner Lueg. *Stahl und Eisen,* v. 77, Oct. 1957, p. 1368-1374.

Phosphate, oil and Si lubrication. 11 ref. (F28; ST, NM-h)

14-F. (Polish.) **Rolling and Heat Treatment of Textured Transformer Plates.** A. G. Petrenko. *Hutnik,* v. 24, July-Aug. 1957, p. 277-282.

Influence of silicon and carbon content, grain size and production techniques upon magnetic properties and plasticity of cold rolled transformer plates; technology applied in U.S.S.R. (F23, P16, Q24; SGA-r, AY)

15-F. (Russian.) **Forging and Stamping of Heat Resistant Alloys.** D. I. Berezhovskii. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1957, p. 50-61.

Reviews foreign publications on metallurgy, technology and preliminary treatment of heat resistant ingots used in forging or stamping of turbine blades, rotors and other parts. 18 ref. (F22, G3; SKA-h)

16-F. (Russian.) **Graph of Faster Feeding of Hot Metal Into Blooming Mills.** V. S. Kaprov and D. P. Zhidetskii. *Metallurg,* v. 2, July 1957, p. 24-26.

A new, faster process of handling both killed and rimmed steel billets between casting and rolling. (F23n, W12, 1-52; ST)

17-F. Cored 90-Mm. Gun Tubes Extruded in 5 Minutes. Henry J. Decelle, Adam A. Krystofik and John Penrose. *American Machinist,* v. 101, Nov. 18, 1957, p. 158-161. (F24a, T2m; ST)

18-F. Multiple Cold Drawing of Tubes With Phosphating—Methods in the U.S.S.R. *Corrosion Prevention and Control,* v. 4, Oct. 1957, p. 59-60, (From *Stal',* v. 17, no. 3, 1957, p. 243).

Previously abstracted from original. See item 152-F, 1957. (F26r; NM-h)

19-F. Operation of a Canadian Strip Mill. R. J. Barry. *Iron and Steel Engineer,* v. 34, Nov. 1957, p. 90-95.

At the Steel Co. of Canada. (F23, 1-52, 4-53; ST)

20-F. Billet Heating—New Johnstown Rod Mill. F. R. Pullen. *Iron and Steel Engineer,* v. 34, Nov. 1957, p. 134-140.

New furnace has hourly tonnage rate of over 60 tons at the Johnstown plant of Bethlehem Steel Co. (F21b; ST, 4-52)

21-F. Hot Extruded Steel Shapes Can Save You Money. R. L. Hugo. *Materials in Design Engineering,* v. 46, Nov. 1957, p. 124-125. (F24; ST)

22-F. Wrought Titanium. J. R. Crane. *Metal Industry,* v. 91, Nov. 22, 1957, p. 435-438, 444.

Melting; fabrication factors; forging; machining. (To be continued.) (F22, C21, G17; Ti)

23-F. Production of Forgings at the Bromsgrove Works of Garringtons Ltd. *Metal Treatment and Drop Forging,* v. 24, Nov. 1957, p. 459-464.

For such components as gear blanks and connecting rods. (F22; ST)

24-F. Development of a Process to Produce Zirconium. Hanford-Type Process Tubing by Roll Forming and Inert Arc Welding. R. A. Noland and G. B. O'Keeffe. Argonne National Laboratory. *U. S. Atomic Energy Commission,* ANL-5110, May 1, 1953, 43 p. (CMA) (F26s; Zr)

25-F. Extrusion of Arc Melted Sponge Hafnium Cruciform Shapes. J. Halapatz. Westinghouse Atomic Power Division. *U. S. Atomic Energy Commission,* WAPD-MDM-7, May 5, 1954, 10 p. (CMA) (F24; Hf)

26-F. Casting and Fabrication of Binary Alloys of Uranium With Molybdenum, Aluminum, Silicon, Titanium and Vanadium. R. E. Macherey and R. J. Dunworth. Argonne National Laboratory. *U. S. Atomic Energy Commission,* ANL-5341, June 15, 1956, 24 p. (CMA) (F23, C5; U, *Mo, Al, Si, Ti, V*)

27-F. Lubrication in Wire Drawing. J. G. Wistreich. *Wire Industry,*

v. 24, Oct. 1957, p. 954-958.

Conditions in die, methods of lubrication, forced lubrication and performance of die. (To be continued.) (F28; 18-73)

28-F. (German.) Layout of High Capacity Rolling Mills for Steel Sections and Wire Rod. Hans Peter Lemm. *Stahl und Eisen,* v. 77, Sept. 1957, p. 1181-1195.

Comparison of semicontinuous and continuous plants; handling and treating billets charged into continuous rolling mill trains. 5 ref. (F23q, W23d; 4-53, 4-57, 18-67; ST)

29-F. (Russian.) Cooling Technology for Rolled Stock Sensitive to Flaking. D. A. Litvinienko, V. V. Turitsyn and P. N. Sporyshkov. *Metallurg,* v. 2, July 1957, p. 23-24.

New, shorter cooling schedules for steels sensitive to flaking on rolling. (F23; ST, 9-70)

Secondary Mechanical Working

Forming and Machining

1-G. Surface Grinding Aluminum Products. John E. Hyler. *Light Metal Age,* v. 15, Oct. 1957, p. 38. (G18k; Al)

2-G. Grinding Titanium. S. B. Watts. *Light Metals,* v. 20, Oct. 1957, p. 336-337. (CMA)

Titanium is easily ground at Lockheed by using speeds of less than 1800 sfpm., a nitrite-amine rust inhibitor as a cutting fluid, and (for cylindrical grinding of the center type) 400-500 in. table feed, 0.001 in. downfeed and 0.05 in. crossfeed. (G18; Ti)

3-G. Development in Methods of Forming Titanium. *Machinery (London),* v. 91, Oct. 11, 1957, p. 853-857. (CMA)

The Aircraft Engine Division of Ford has developed forming methods for inlet guide vanes and compressor blades from titanium sheet. Procedures for folding sheet in a heated tool, resistance welding the trailing edges and expanding in a closed die to give the finished vane, and for roll-forging the compressor blades from an induction heated blank. (G1; Ti)

4-G. Dimensional Etching. Its Application to Airframes. Richard H. Andrew and Jacques L. Duvall. *Plating,* v. 44, Nov. 1957, p. 1186-1190.

Chemical milling process. 5 ref. (G24b, T24)

5-G. HRP Titanium Fabrication Experience From Loop T-1 Construction. P. A. Haas. *U. S. Atomic Energy Commission,* CF-56-3-167, Mar. 15, 1956, 11 p. (CMA)

Titanium is easily arc welded to give sound joints with high tensile strength. Oxygen, hydrogen or nitrogen pickup from air or water vapor causes cold embrittlement, and the metal must be protected by an inert gas atmosphere until it cools below 1100° F. The machinability of titanium is comparable to that of stainless steel. (G17, K1; Ti)

6-G. Transfer Lines Build Buick's New Dynaflow. *American Machinist,* v. 101, Nov. 4, 1957, p. 135-140.

Permanent mold Al castings for the case and rear bearing retainer are machined. (G17, 18-74; Al, 5-63)

7-G. Effect of Tool-Chip Contact Area in Metal Machining. H. Takeyama and E. Usui. *Journal of Applied Mechanics,* Paper no. 57-A-45, 1957, p. 1-5.

Results of experimental, two-dimensional machining of brass tubes with tools specially designed to keep tool-chip contact areas constant. Analysis of coefficient of friction, stress distributions on rake face, significance of tool-chip contact area as related to machining performance. 10 ref. (G17; Cu-n)

8-G. Metal Spinning. New Imported Equipment Spins Economy Into Aircraft and Missile Parts. *Missiles and Rockets,* v. 2, Oct. 1957, p. 110-117. (G13, 1-52)

9-G. Cold Forming in Missile Production. *Missiles and Rockets,* v. 2, Oct. 1957, p. 118-119.

Cold extrusion at Norris-Themader Corp. (G5)

10-G. (German.) Machining of Aluminum With Diamonds and Cutting of Close-Tolerance Threads. K. Sterl. *Aluminium,* v. 33, Sept. 1957, p. 613-615.

Various forms of turning, recessing and drilling with diamonds; choice of tools and their treatment. Internal threads are best cut with single-pass plug taps with ground threads, narrow tooth webs and wide grooves; a new "elastic" tool for external threading. (G17; Al, SGA-j, NM-K37)

11-G. (German.) Forming of Threads. *Draht,* v. 8, Aug. 1957, p. 293-296.

The technology of warm and cold threading, particularly of material of high tensile strength; dies and rollers are used for forming threads, the tools being mounted on various types of semi-automatic and fully automatic threading machines. (G17f)

12-G. (German.) Theory of Stock Removal. M. Kronenberg. *Werkstatt und Betrieb,* v. 90, Oct. 1957, p. 729-733.

The chip is considered as a moving system. A formula establishes a relationship between the chip compression factor, the coefficient of friction and the true rake angle of the tool. 8 ref. (G17)

13-G. (Japanese.) Cutting by Powder Method. Minoru Iwasa. *Casting Institute of Japan, Journal,* v. 29, Aug. 1957, p. 621-626.

Cutting of stainless steel and copper alloys by heat of oxidation of iron powder. Concrete and firebrick were also cut by iron and aluminum powder. (G22; Cu, SS)

14-G. (Russian.) Deep Drawing of Certain Sheet Metals and Alloys at Various Speeds With Application of Heat. N. A. Klyucharev. *Vestnik Mashinostroeniya,* v. 37, Aug. 1957, p. 40-45.

Drawing of steel, brass, aluminum and duraluminum; design of the press; drawing coefficients at speeds of 0.2 and 43 cm. per sec.; wall thicknesses at different height levels of the drawn specimen. (G4b, 1-66; ST, Cu-n, Al)

15-G. (Russian.) Influence of Soft Sheet Steel Properties Upon Durability of Punching Stamps. P. G. Kovtun. *Vestnik Mashinostroeniya,* v. 37, Aug. 1957, p. 46-47.

Investigation of working life of deep drawing stamps in respect to size of ferrite grain and carbon contents of the sheet steel. (G4b, 1-52; CN)

16-G. Special Techniques for Increasing Strength and Fatigue Life of Steel Stressed in Torsion. N. E. Hendrickson. *ASTM Bulletin,* v. 224, Sept. 1957, p. 40-42.

Shot peening and presetting make it possible for 40 lb. of steel in torsion bar springs to do a job that would otherwise require almost twice as much material. 4 ref. (G23n, T7c; ST)

17-G. How to Remedy Defects in Drawn Shells. Federico Strasser. *Iron Age,* v. 180, Nov. 21, 1957, p. 125-127. (G4c, 9)

18-G. Resistance Heating Titanium Alloys for Press Brake Forming. *Machinery (London),* v. 91, Oct. 18, 1957, p. 917. (CMA)

(G4d, W28; Ti)

19-G. Forming Titanium With Particular Reference to the Production of Aircraft Components. J. S. Kirkpatrick. *Sheet Metal Industries,* v. 34, Nov. 1957, p. 825-830. (CMA)

Forming on stretch press, press brake, deep drawing and skinning. (G4d, G9, G13; Ti)

20-G. Choose the Right Lubricant. Pt. 2. *Steel,* v. 141, Oct. 21, 1957, p. 100-101.

Types of lubricant for drawing and forming operations. (G4; NM-h)

21-G. Tips on Turning Heat Treated Steels. *Steel,* v. 141, Nov. 25, 1957, p. 94-95.

(G17a, 2-64; ST)

22-G. Short Run Dies Offer Long Life. *Steel,* v. 141, Dec. 2, 1957, p. 94-96.

New ideas and methods of pressing lengthen life of dies. (G3, W24n)

23-G. Chem-Milling Handles Tough Job. *Steel,* v. 141, Dec. 2, 1957, p. 114.

Advantages of this complex method used in production of aircraft part. (G24b, T24a; Al)

24-G. From Sandstones to Diamonds —the Grinding Wheel Story. F. W. Foerste. *Welding Engineer,* v. 42, Dec. 1957, p. 34-37.

(G18, 6-69)

25-G. Understanding Grinders and Grinding Wheels. *Welding Engineer,* v. 42, Dec. 1957, p. 41-43.

Uses for grinding wheels; factors in selection of wheels; work speed; types of machines available. (G18)

26-G. Application and Working of Honeycomb Core. Pt. 2. W. A. Nordhoff. *Western Machinery and Steel World,* v. 48, Nov. 1957, p. 90-93.

(G general, T24a; 7-59)

27-G. Spinning Titanium Pressure Vessels. Fred Spiegl. *Western Metals,* v. 15, Nov. 1957, p. 48-49.

(G13, T26q; Ti)

28-G. Radial Draw Forming Contributes Design Economies for Jet Transport Production. *Western Metals,* v. 15, Nov. 1957, p. 44-46.

(G4, T24a)

29-G. (Dutch.) Method for Putting a Linear Network Upon Metal Surfaces. J. H. Zaat. *Metalen,* v. 12, Oct. 15, 1957, p. 387-390.

A method for applying to a metal surface a linear network (raster) which will adhere well, resist deformation and which has clear and sharp lines. This linear network is used for measuring deformations which occur in nonchipping metalworking. One of the most important applications is the processing of sheet material. (G24b, G24d, L13q)

30-G. (French.) Ceramic Tools for Turning Operations. A. B. Albrecht. *Machine Moderne,* v. 51, Oct. 1957, p. 41-45.

Tools made of ceramics and oxides can improve cost prices and production times in high-speed turning operations. The accuracy of the proc-

ess is extremely good. Powerful machine tools with high accuracy and high speeds are needed.
(G17a, T6n; 6-70)

31-G.* (German.) **Rimming Steel.** Heinz Becker and Hubert Hoff. *Stahl und Eisen,* v. 77, Sept. 1957, p. 1215-1220.

Structure, mechanical properties, cutting forces, face wear, abrasion, chip volume and surface roughness during and after machining; effect of the Mn and Pb content on the machinability of free-cutting steel of the rimming type. 4 ref.
(G17k, 2-60; ST-d, *Pb, Mn*)

32-G. (German.) **Tool Wear in Machining.** Gustav Vieregge. *Stahl und Eisen,* v. 77, Sept. 1957, p. 1233-1244.

Wear-cutting speed curves as a means of determining the importance of the types of wear in cutting tool life. Influence of feed, process and tool material (toolsteel, stellite, carbides and ceramic) on the material machined (carbon steel and gray iron castings). 10 ref.
(G17, Q9; CN, CI-n, TS, 6-69, 6-70)

H Powder Metallurgy

1-H. Evaluation of Titanium Powder for Metallurgical Use. Craig T. Waldo. Knolls Atomic Power Laboratory. *U. S. Atomic Energy Commission,* KAPL-M-CTW-1, Apr. 25, 1956, 15 p. (CMA)

Titanium powders from six sources were cold pressed, sintered, hot rolled, pickled and machined. Test data were obtained for hardness, bending, tensile strength and microstructure. Vacuum system used in the study. (H12; Ti)

2-H. Powder Metallurgy as an Aid to Production Engineering. G. R. Bell and L. M. Maricchi. *Engineer and Foundryman,* v. 22, Aug. 1957, p. 54-60.

Applications and production presses. (H general, 1-72)

3-H. (German.) **History of Metal Powders.** F. M. Feldhaus. *Planseeberichte für Pulvermetallurgie,* v. 5, Aug. 1957, p. 54-55.

9 ref. (H general, A2)

4-H.* Preparation of Uranium and Uranium Alloy Powder Metal Compacts. Herbert S. Kalish. *American Society for Metals, Transactions,* v. 51, Preprint no. 63, 1957, 22 p.

Uranium parts have been made by cold pressing and sintering, hot pressing and powder rolling. Hot pressing appears to be the most favorable for unalloyed uranium, yielding fine grain size, random orientation uranium parts, and is amenable to the fabrication of slugs and hollow cylinders. Cold pressing and sintering appear most promising for making uranium alloy parts.
(H14, H15; U)

5-H.* Sweden: Iron Powder to Rolled Steel in One Operation. Bo Kalling, Sven Eketorp and Sven Backstrom. *Journal of Metals,* v. 9, Nov. 1957, p. 1440-1444.

The Stora powder steel process developed by Stora Kopparbergs Bergslags A/B, Sweden. Granulated pig iron is decarburized with iron oxide, and the low-carbon product is rolled directly to compact steel. 11 ref. (H10c, H14j; Fe, ST)

6-H.* Vacuum Sintering. Pt. 2. Henry H. Hausner. *Precision Metal Molding,* v. 15, Nov. 1957, p. 91-92, 94-95.

Effects of sintering atmosphere on porosity and pore migration in Cu powders. Experiments show that vacuum sintering not only affects the density and total porosity but especially the distribution of pores of various sizes throughout the sintered compact. Pore-size distribution determines the grain structure. (To be continued.)
(H15, 1-73, H11; Cu, 6-70)

7-H.* Introducing Commercial Titanium Powder. Alfred R. Globus. *Precision Metal Molding,* v. 15, Dec. 1957, p. 38-39, 79.

New UniFide Ti powder of United International Research Inc. is stable and shows no tendency to spontaneous combustion. Unlike powder made from Ti sponge this powder consists of tiny individual particles offering excellent compressibility. 4 ref.
(H10; Ti)

8-H.* Vacuum Sintering. Pt. 3. Henry H. Hausner. *Precision Metal Molding,* v. 15, Dec. 1957, p. 44-46, 69.

Comparison of A-sintered and vacuum sintered Be campacts. Effect of sintering temperature on density and electrical resistivity; effect of compacting pressure on the pressed density of compacted Zr and Zr hydride powders. 16 ref.
(H15, 1-73, H12; Be, Zr)

9-H. Titanium Carbide. J. C. Redmond. *Product Engineering,* v. 28, Nov. 11, 1957, p. 84-86. (CMA)

Powder metallurgy techniques.
(H general, P general, Q general; Ti, 6-69)

10-H. How to Give Powdered Metals Strength. *Steel,* v. 141, Nov. 25, 1957, p. 110-111, 114.

By filling pores with another metal, notch effects are eliminated. Physical properties controlled by varying conditions and materials.
(H16e; ST, Cu)

J Heat Treatment

1-J. Heat Treatment of Mild Steel in Raw Town-Gas and Ammonia Atmospheres. A. H. Howes and E. Mitchell. *Iron and Steel Institute, Journal,* v. 187, Nov. 1957, p. 177-190.

Effects of temperature in the 800-900° C. range and of ammonia content up to 10% on surface layers of mild steel heated in raw town-gas. Hardenability of carbon-rich surface layers is increased with the addition of nitrogen, and surface layers of adequate hardenability which are martensitic after oil quenching are produced when mild steel is heated in the 850-900° C. range in an atmosphere of low ammonia concentration. 13 ref. (J2k; CN)

2-J. Tantalum Annealing and Degassing and Hardness Effects of Dissolved Gases. Ralph H. Perkins. Los Alamos Scientific Laboratory. *U. S. Atomic Energy Commission,* LA-2136, Sept. 30, 1957, 41 p. 7 ref.

(J23, N15, Q29; Ta)

3-J. (German.) **Induction Surface Hardening of Cast Iron.** E. A. Hohmann. *Giesserei Praxis,* v. 75, Sept. 10, 1957, p. 374-375.

Basic principle; equipment and operation; samples; calculation of hardening depth; economics. 6 ref.
(J2g; CI)

4-J. (German.) **Flame Hardening of Welds.** Valentin Trunschitz. *Schweisstechnik,* v. 11, July 1957, p. 80-84; v. 11, Aug. 1957, p. 93-95.

Deformation in weld structure; gas fuels; experiments in locomotive wheel flange hardening; evaluation of experiments; flame hardening of weld reconditioned locomotive wheels; equipment, economics. 6 ref. (J2h; ST, 7-51)

5-J. (Russian.) **Properties of No. 45 Steel With Boron Added.** Ya. E. Goldshtein, L. S. Lyakhovich, L. L. Pyatakova and G. M. Trusenev. *Stal',* v. 17, May 1957, p. 449-452.

Hardenability is increased with the addition of 0.002 to 0.006% boron with corresponding improvement in other properties. It is recommended for such parts as crankshafts that are heat treated by induction.
(J5, Q general; AY, *B*)

6-J. Liquid Petroleum Gas (L.P.G.) for Gas Carburizing. D. A. Colwell and J. S. Anderson. *Australian Institute of Metals, Journal,* v. 2, Aug. 1957, p. 45-47.

Use of high-purity propane gas for generation of endothermic gas for carburizing furnace atmosphere.
(J28g; RM-g)

7-J. Heat Treatment of Welded Joints. K. Frauenfelder. *Brown Boveri Review,* v. 44, June-July 1957, p. 290-294.

Importance to welding in general of preheating and stress-relief heat treatment; details of Brown Boveri induction heating equipment and the cable inductors available; practical hints on the process.
(J1a, W27k, K9p, K9q)

8-J. Heat Treating on Production Line Minimizes Handling. Herbert Chase. *Machine and Tool Blue Book,* v. 52, Nov. 1957, p. 129-137.

Heat treating methods and automatic equipment used at Chrysler transmission plant.
(J23, J28; 18-74)

9-J. Flame Surface Hardening Reduces Distortion. Joseph H. Bockrath. *Metalworking,* v. 8, Nov. 1957, p. 6-7.

Using selective surface hardening instead of the usual cyanide case hardening cut distortion 88%, permitting the use of higher strength alloy steel for textile-machine cylinders and dials. (J2h; AY)

10-J. Prepared Annealing Atmospheres. George J. Campbell. *Steel,* v. 141, Nov. 18, 1957, p. 160-175.

Tips on avoiding difficulties with atmospheres in annealing low-carbon strip. (J23, J2k; ST)

11-J. (German.) **Potentialities and Limitations of Induction Hardening. Pt. 2.** W. Barth. *Fertigungstechnik,* v. 7, July 1957, p. 304-310.

Development of equipment, especially of the middle and high-frequency type. 9 ref. (J2g, 1-52)

12-J. (German.) **Experience With Low-Alloy Case Hardening Steel.** B. Voschenilek. *Fertigungstechnik,* v. 7, July 1957, p. 311-319.

Low-alloy (Ni, Mo, Cr, Mn) steels are tested for hardenability and mechanical properties after various forms of heat treatment. Influence of the hardening temperature; TTT-diagrams; influence of the size of the workpiece and depth of carburization. 26 ref. (J28, J5; AY)

13-J. (German.) **Hardening of Alloys With Beryllium Additions.** R. Reinbach. *Draht,* v. 8, Aug. 1957, p. 313-314.

Nonferrous alloys with beryllium are important for springs. Those most frequently used are tabulated, showing composition and mechanical properties before and after hardening. 4 ref.
(J7, T7c, 17-57; EG-a38, *Be*)

14-J. (Polish.) **Problems of Decarburization of Transformer Steel Plates.** J. Groyecki. *Hutnik,* v. 24, July-Aug. 1957, p. 289-295.

Decarburization of the steel in atmosphere of CO-CO_2 and H_2-CH_4. Results of decarburization of low-carbon and silicon steels. 7 ref.
(J4a; SGA-r, AY)

15-J. (Polish.) **Supplementary Heat Treatment of Transformer Steel Plate.** F. Khol. *Hutnik,* v. 24, July-Aug. 1957, p. 299-301.

Influence of the dead weight of the transformer plates upon their magnetic properties; selection of the conditions of heat treatment.
(J general, P16; SGA-r, AY)

16-J. (Russian.) **Effect of Barium Carbonate Content in Carburizer on the Quality of the Case.** A. M. Tarasov and M. R. Semenchenko. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 49-53.

Barium carbonate is an activator of carbon; effect varies with the susceptibility of different steels to carburization. (J28g)

17-J. (Russian.) **Means of Increasing the Effectiveness of Solid Carburizers.** L. K. Luksha. *Metallovedenie i Obrabotka Metallov,* no. 6, June 1957, p. 51-54.

Sodium acetate added to the usual carbonate salts in solid carburizers definitely improves their effectiveness and reduces the time required for carburizing. (J28g)

18-J. (Russian.) **Magnetic Investigation of Tempered Nitrided Iron and Steel.** V. G. Permyakov. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1957, p. 15-16.

Comparison of tempering hardened steel, hardened nitrided iron and hardened nitrided steel. 5 ref.
(J29, J28k; ST)

19-J. (Russian.) **Annealing of Heat Resistant Aluminum-Iron Alloys.** P. A. Parchutik. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1957, p. 37-40.

Annealing leads to the partial coagulation and spheroidization of the eutectic components. Components in the molten alloy, hardening along the eutectic structure, solidify and the further formation of $FeAl_3$ is disrupted. (J23; Al, Fe, SGA-h)

20-J. (Russian.) **Use of Sylvanite With Soda in Alloy Salt Baths.** E. A. Smolnikov. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1957, p. 40-42.

Sylvanite melted with deoxidized boron may be used for heating parts which are quenched in water, water solution of NaCl, or NaOH. For oil quenching 20% soda should be added to the bath.
(J2j, W28p, 1-52)

21-J. (Russian.) **Elimination of Preliminary Heat Treatment of Steel to Be Case Hardened.** I. V. Samolov. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1957, p. 46-50.

Of 24 stampings, half were normalized and the rest not, but all were case-hardened in the same manner. Tests showed no substantial difference in the main mechanical properties of the two batches.
(J28, J24, Q general; ST)

22-J. Modified Martemp Cuts Warping. Edgar C. Wallace and Howard E. Crouse. *Steel,* v. 141, Dec. 2, 1957, p. 97-98.

Floor plan and procedure for heat treating intricate and expensive parts. (J26p, 18-67; ST)

23-J. (Russian.) **Application of Protective Coating to Minimize Decarburization.** S. Z. Yudovich. *Stal',* v. 17, Jan. 1957, p. 69-71.

Applying a solution of sodium silicate to the surface of the work will reduce decarburization in chromium steel. (J4a; AY, *Cr*)

24-J. (Russian.) **Heat Calculation of Surface Induction Heating.** A. V. Donskoi and P. V. Firsov. *Vestnik Mashinostroeniya,* v. 37, Aug. 1957, p. 65-70.

Formula for computation of the temperature difference between the heated object and the surrounding air. Formula for computation of the penetration depth of the heat wave. 3 ref. (J2g)

25-J. (Russian.) **Repair of Steam Turbine Disks Applying Relaxation Method.** A. M. Konienko. *Vestnik Mashinostroeniya,* v. 37, Aug. 1957, p. 77-79.

Disks are heated to 570° C. under small loads. Diagram of the heating device. (J1; ST)

26-J. Quenching Oil Does Make a Difference. Chris Hendra. *American Machinist,* v. 101, Oct. 21, 1957, p. 160-161.

Requirements of quenching oil used for steel and cast iron parts following furnace heat treatment.
(J26, W28p, T21f; CN-g, CI)

27-J.* Effect of Copper on the Heat Treating Characteristics of Medium-Carbon Steel. R. A. Grange, V. E. Lambert and J. J. Harrington. *American Society for Metals, Transactions,* v. 51, Preprint no. 62, 1957, 25 p.

The effect of up to 1.5% Cu on hardenability, isothermal transformation, equilibrium transformation temperatures, temperature range of martensite formation, softening of martensite on tempering, and precipitation hardening was determined for a 0.45% C steel containing graded amounts of Cu. 9 ref.
(J general, N8, 2-60; CN, *Cu*)

28-J.* Application of the Endothermic Atmosphere Generator and Automatic Atmosphere-Control Instruments to Australian Fuels. Norbert K. Koebel. *Australian Institute of Metals, Journal,* v. 2, Aug. 1957, p. 27-45.

Principles and chemistry of operation of endothermic generator. Application to carburizing and neutral hardening and problems in obtaining proper grades of fuel. Status, principles and applications of automatic atmosphere control instruments.
(J2k, W28q, X7j, 1-72)

29-J.* Stress Relief of Mild Steel Welded Structures. S. J. Watson. *British Welding Journal,* v. 4, Sept. 1957, p. 422-423.

Tests of tensile relaxation type carried out on mild steel annealed from 500 to 650° C. to determine effect of varying annealing time and temperatures on residual stress. 5 ref. (J1a; CN, 7-51)

30-J.* Influence of Stress-Relieving on the Initiation of Brittle Fracture in Welded Plate Specimens. R. Kennedy. *British Welding Journal,* v. 4, Nov. 1957, p. 529-534.

Effect of pre and post-welding stress relief. In untreated specimens, brittle fracture occurred at low applied stress in the 10-25° C. range. Stress-relieving treatments safeguard against initiation of such failures; the more effective the stress relief the greater the safety. 4 ref.
(J1a, Q26s, K9p, K9q)

31-J.* Heat Treatment of Silicon Using Zone Heating Techniques. H. C. Theuerer, J. M. Whelan, H. E. Bridgers and E. Buehler. *Electrochemical Society, Journal,* v. 104, Dec. 1957, p. 721-723.

Changes in Si with solid-state heat treatment have been obtained with the aid of the floating zone apparatus normally used to refine Si. With this system, a liquid or solid hot zone may be caused to traverse the rod while the rest of the apparatus is kept relatively cool. Contaminants left on the Si surface even after careful etching and washing procedures are a controlling factor in the observed heat treating effects. 3 ref. (J general, C28k; Si)

32-J.* Heat Treating Plain Carbon and Low-Alloy Steel. *Iron Age,* v. 180, Oct. 24, 1957, p. 207-222.

Types of heat treatment and advantages and limitations for plain carbon and low-alloy steels, cast irons, stainless steel and aluminum. Methods of procedure and equipment.
(J general, CN, AY, CI, SS, Al)

33-J. How to Get More Out of Type 410 Stainless Steel. *Materials in Design Engineering,* v. 46, Nov. 1957, p. 143.

Rules to observe in heat treating.
(J general; SS)

34-J.* Modern Heat Treatment Facilities. Daniel A. Tullock, Jr. *Metal Progress,* v. 72, Nov. 1957, p. 75-78.

Heat treating equipment for hardening and coloring high-strength studs and bolts without damage to threads is installed in new building, a model of cleanliness, ventilation, light and elbow-room in the basement.
(J26n, J29, W27g, W12r, 1-52; ST)

35-J. Heat Treating the Aluminum Alloys. G. W. Birdsall. *Metal Treating,* v. 8, Sept-Oct. 1957, p. 2-5, 56.

Basic principles of metal solidification, importance of solid solution, solid diffusion, precipitation in the heat treatment of Al alloys.
(J general; Al)

36-J.* Precipitation Hardening Stainless Steels. *Metal Treatment and Drop Forging,* v. 24, Nov. 1957, p. 437-438.

New steel, F.V. 520, developed by Firth-Vickers, is capable of withstanding high frictional temperature aircraft and missile applications and possesses high tensile and fatigue resistance, 500° C. ceiling temperature for service and stainless properties equivalent to 18-8 steels.
(J27, Q general; SS)

37-J. Manufacture of Steel Springs. *Metal Treatment and Drop Forging,* v. 24, Nov. 1957, p. 465-467.

Automatic methods of heat treatment at Alco Products Inc., Chicago Heights. (J general, T7c; CN)

38-J. Vacuum Heat Treating Hairsprings. Tom Raedy. *Steel,* v. 141, Oct. 21, 1957, p. 94-97.

Hairsprings of Ni-Span "C", a Ni-Cr-Fe-Ti alloy and other metals heat treated in vacuum to prevent surface oxidation.
(J2k, 1-73, T7c; Ni, Cr, Fe, Ti)

39-J. (Dutch.) **Cost Saving by Isothermal Soft Annealing.** C. H. Luiten. *Metalen*, v. 5, Oct. 15, 1957, p. 391-394.

In the initial shaping of knives and scissors by warm forging, the steel is usually heated beyond the hardening temperature. In normal cooling in air hardness increases. Hence a soft annealing treatment is necessary after forging to improve machinability. The separate annealing treatment can be successfully replaced by isothermal annealing, in which the cooling from forging temperature at 700° C. is interrupted for some time. (J23s; ST)

40-J. (German.) **Hardened Copper-Titanium-Aluminum Alloy.** W. Gruhl and H. Cordier. *Metall*, v. 11, Nov. 1957, p. 928-933. (CMA)

By addition of titanium and appropriate heat treatment, copper can be appreciably hardened. The procedure has never been industrially applied. Satisfactory results can be had by adding Al together with Ti. The alloy was heated at 800° C. for 5 hr., quenched in water or air for a few minutes, and hardened by a prolonged annealing at 350-500° C. 11 ref. (J23, J26; Cu, *Ti, Al*)

41-J.* (German.) **Heat Treatment of Toolsteels.** Josef Frehser and Otmar Lowitzer. *Stahl und Eisen*, v. 77, Sept. 1957, p. 1221-1233.

The mechanism of the change in dimensions during heat treatment of nonhardenable steels and toolsteels with different quenching temperatures. Effect of thermal and transformation stresses in behavior of steels and in dimensions of tools during heat treatment. 13 ref. (J general, P10d; TS)

K Assembling and Joining

1-K. Diffusion Bonding of Zircaloy to Stainless Steel Tubing. K. M. Gerken. Knolls Atomic Power Laboratory. *U. S. Atomic Energy Commission*, KAPL-M-JMG-10, May 29, 1957, 14 p. (CMA)

Diffusion bonded joints did not fail after thermal cycling 200 times in the 100-600° F. range or after pressure cycling 100 times in the 100-3900 psi. range. Hydraulic bursting pressures to 13,200-17,200 psi. were needed to cause failure in well-bonded joints. The tapered butt joint design is recommended. (K5k; Zr, SS, 4-60)

2-K. Welding of Titanium and Titanium Alloys Containing Boron. Final Report. J. M. Gerkin. Knolls Atomic Power Laboratory. *U. S. Atomic Energy Commission*, KAPL-M-JMG-1, July 17, 1956, 7 p. (CMA)

For all of the Ti-B and Ti-Al-V-B alloys studied the hardness of the heat affected and weld zones was greater than that of the unwelded plate, while the ductility of the weld zones could be restored to its former level. The Ti-Al-V-B alloys have more ductility and much more strength than the Ti-B alloys for comparable contents of boron. 3 ref. (K general, Q27a, Q29n, 2-60; Ti, *B*)

3-K. Joining of Molybdenum. W. N. Platte. Wright Air Development Center, Technical Report 54-17. *U. S. Office of Technical Services*, PB 128527, Aug. 1954, 108 p. (CMA)

Welds in deoxidized arc-cast molybdenum are subject to hot short cracking when the oxygen content of the argon atmosphere around the arc exceeds 0.2%, and the ductility of the welds is reduced drastically by the presence of more than 0.05% oxygen. Oxygen in sintered molybdenum produces porosity and hot short cracking, but good welds have been obtained by using deoxidizing agents. (K1d; Mo, 9-72)

4-K. Welding of Type 347 Steels. Arthur Hoerl and Thomas J. Moore. *Welding Journal*, v. 36, Oct. 1957, p. 442s-448s.

Statistical analysis of effects of various elements on crack sensitivity of fully austenitic Type-347 welds. 12 ref. (K9r, 2-60, 9-72; SS)

5-K. Mechanism of Microcracking in Mild-Steel Welding. K. Winterton. *Welding Journal*, v. 36, Oct. 1957, p. 449s-456s.

Theory in terms of the accumulation of hydrogen under pressure in pre-existent flaws, specifically incipient hot cracks and misfits at the boundaries of nonmetallic inclusions. 19 ref. (K9Ni; CN, 9-72)

6-K. High-Temperature Brazing of Aluminum Bronze to Inconel. Donald Caplan and Ernest F. Nippes. *Welding Journal*, v. 36, Oct. 1957, p. 457s-464s.

Brazing aluminum bronze without flux; and alternately brazing with suitable fluxes based on mixed chlorides soluble enough to be readily removed. 29 ref. (K8, 2-62; Cu-s, *Al*, Ni)

7-K. Thermal Analysis of Brazing and Hard-Surfacing Alloys—a Proposed Method. Forbes M. Miller. *Welding Journal*, v. 36, Oct. 1957, p. 986-991.

Simple, practical and accurate means for determining liquidus and solidus temperatures for brazing and hard surfacing alloys which melt within the range of 1600 to 2100° F. (K9; SGA-f)

8-K. Zinc Soldering of Aluminum. I. B. Robinson. *Welding Journal*, v. 36, Oct. 1957, p. 992-997.

Zinc soldering with the proper fluxes, solder and procedures provides simple method for joining aluminum to itself and dissimilar metals at intermediate temperatures to provide strong, easy-to-make, corrosion resistant joints. 4 ref. (K7; Al)

9-K. (German.) **Modern Welding.** A. Hohmann. *Giesserei-Praxis*, v. 75, Sept. 30, 1957, p. 409-413.

Hot, cold and low heat processes; welding methods for gray cast iron, cast steel and malleable cast iron. Advantages of cast-weld construction. (K general; ST, CI)

10-K. (German.) **Safety of Welded Construction.** A. Slattenschek. *Schweisstechnik*, v. 11, Aug. 1957, p. 85-93.

Calculation of stress-strain; laboratory testing; unsafe conditions in welded construction; safety measures. 21 ref. (K general, A7; ST, SGB-s)

11-K. Report on Strength of Welded Joints in Carbon Steel at Elevated Temperatures. Special Task Group of the Petroleum and Chemical Panel of Joint ASTM-ASME Research Committee. *ASME Transactions*, Paper no. 57-PET-1, 1957, p. 1-12.

Evaluation of strength of composite specimens including weld, heat affected metal and base metal, exclusive of any effects of mechanical notches, reinforcement, flaws, undercuts, etc. Material tested was silicon-killed carbon-steel plate. (K9r, 2-62; CN, 4-53)

12-K. Problems of Arc Welding Heavy Steel Objects. A. Lüthy and A. Schmid. *Brown Boveri Review*, v. 44, June-July 1957, p. 260-270.

Edge preparation, welding technique, electrode selection, post-welding heat treatment, testing of seams. (K1, K9q, K9r; ST)

13-K. Function of Fluxes in Automatic Arc Welding. A. L. Saboz and C. G. Telschow. *Brown Boveri Review*, v. 44, June-July 1957, p. 286-290.

Drawbacks encountered when welding with bare wire electrodes; function of welding fluxes used for automatic arc welding; differences between premelted and agglomerated fluxes; effect of fluxes on the welding process. (K1; RM-q)

14-K. Microcracking in Mild Steel Weld Metal. Pt. 1. K. Winterton. *Canadian Metalworking*, v. 20, Sept. 1957, p. 34-42.

Relationship between cooling rate, plate temperature, hydrogen content, hydrogen diffusion rate, nonmetallic inclusions and microcracking with 15 common electrodes. (To be concluded.) (K9, W29h, 1-52; CN, 9-72)

15-K. Joining Mild Steel? How to Select the Right Electrode. C. Cambell. *Canadian Metalworking*, v. 20, Sept. 1957, p. 48-54.

Classification of joints and selection of electrodes. (K1, W29h, 1-52; CN)

16-K. Process That Speeds a Quality Weld. *Design Engineering*, v. 3, Oct. 1957, p. 59-61.

Advantages, limitations, recommended conditions for use of "Aircomatic" process in welding mild steel; examples of use. (K1d; CN)

17-K. Driving Titanium Rivets. T. A. Dickinson. *Modern Machine Shop*, v. 30, Nov. 1957, p. 128-129. (CMA) (K13n; Ti)

18-K. Welding High-Tensile Steels. K. L. Zeyen and H. Schwarz. *Welding Journal*, v. 36, Nov. 1957, p. 480s-482s.

Digest of article published in *Technische Rundschau* (Bern, Switzerland) no. 1/2, Jan. 11, 1957. (K1; ST, SGB-a)

19-K. Butt Welding Austenitic Stainless Steel to Ferritic Steel in Cylindrical Shapes. J. E. Donahue. *Welding Journal*, v. 36, Nov. 1957, p. 1074-1077.

Used in turbine-generator units. 6 ref. (K1; SS-d, SS-e)

20-K. (Czech.) **Weldability at High Temperatures of Austenitic Nickel-Chromium Steel Stabilized With Columbium.** Josef Nemec. *Hutnické Listy*, v. 12, Sept. 1957, p. 788-794.

Weld failures with thick-walled elements attributed to the influence of heat on material adjacent to the weld. Brittle sigma phase and segregations on the boundaries of austenitic grains have unfavorable influences. 13 ref. (K9s; SS, *Cb, Ni, Cr*)

21-K. (German.) **Strength of Bonded Metal Joints.** H. Winter and G. Krause. *Aluminium*, v. 33, Oct. 1957, p. 669-680.

61 ref. (K12)

22-K. (German.) **Reverse Twist in the Production of Wire Cables.** Josef

Regensburger. *Draht,* v. 8, Aug. 1957, p. 285-289.

To avoid unbalance of stresses on individual wires in a cable, a reverse motion of the individual wire is required in relation to the stranding motion. Variable crank mechanisms, planetary gears or Leonard drives are used to generate this motion. (K13a)

23-K. (German.) **Weaving of Heavy Wire Cloth.** A. Jasper. *Draht,* v. 8, Aug. 1957, p. 296-298.

Woof wires must be crimped when the longitudinal force along the warp wire is higher than the maximum force exerted by the weaving frame of the loom. Computations for determining the forces. (K13s; 4-61)

24-K. (German.) **Structural Defects of Austenitic Welds on Ferritic Steels Subjected to Elevated Temperatures.** Friedrich Erdmann-Jesnitzer, Manfred Beckert and Heinz Schmiedel. *Schweissen und Schneiden,* v. 9, Sept. 1957, p. 407-414.

Welding of ferritic steels with austenitic electrodes leads to the formation of a decarburized alpha iron zone close to the weld. This is particularly susceptible to stress-corrosion cracking. Formation of alpha-iron zone of the columnar grain type can be suppressed by suitable carbide-forming additions. Testing apparatus to determine the relation between depth of decarburization and time until fracture. 50 ref. (K1, K9n; ST, 9-72)

25-K. (German.) **Metallurgical Aspects of Welding Heat Resistant 12% Cr + Mo-V-W Alloy Steels.** E. Kauhausen and P. Kaesmacher. *Schweissen und Schneiden,* v. 9, Sept. 1957, p. 414-419.

In the temperature range around 580° C., 12% Cr steel is satisfactory for high-pressure tubes and turbines. Welding can be done under carefully selected conditions. Recommendations for welding procedures with seven different coated electrodes. (K1; SS, SGA-h)

26-K. (German.) **Problems of the Technique of Welding.** Erich Sudasch. *Werkstatt und Betrieb,* v. 90, Oct. 1957, p. 745-753.

Review of papers given at German Welding Engineering Society meeting. (K general)

27-K. (Japanese.) **Consumption of Aluminum, Iron and Copper Welding Electrodes in Air, Argon and Carbon Dioxide.** M. Ozawa, T. Morita and K. Omura. *Electrochemical Laboratory, Bulletin (Denki Shikenja Iho),* v. 21, July 1957, p. 512-517.

Effects of oxygen and oxides; effect of iron oxides on steel; effect of copper oxide on copper; effect of alumina on aluminum. (K1, W29h; ST, Cu, Al)

28-K. (Russian.) **Mechanics of the Development of Hot Cracks in Weld Joints.** V. A. Toropov. *Metallovedenie i Obrabotka Metallov,* no. 6, June 1957, p. 54-58. (Also *Henry Brutcher Translation* No. 3982.)

Theoretical consideration of intercrystalline relationships. 13 ref. (K9n, 9-72)

29-K. (Russian.) **Electroslag Welding Using Magneto-Propelled Apparatus.** M. M. Fikshis. *Stanki i Instrument,* v. 28, Aug. 1957, p. 29-32.

Apparatus suitable for welding of angle joints of any design. Use of one apparatus on each side of the welded part simultaneously is recommended. 9 ref. (K1e, 1-52)

30-K. Squirt Gun Welds Dissimilar Metals. A. R. Kemerer. *American Machinist,* v. 101, Oct. 21, 1957, p. 146-147.

Heavy sections of T-1 steel and 405 stainless welded by semi-automatic submerged arc with 18-8 stainless steel wire and Cr-enriched flux. (K1e; ST, SS)

31-K.* **Welding of Uranium.** J. R. C. Gough and D. Roberts. *British Welding Journal,* v. 4, Sept. 1957, p. 393-403.

Investigation to assess adaptability of argon arc, metal arc and resistance spot welding processes to joining of U. Chemical and physical properties of U and their effect on welding. 18 ref. (K1, K3n; U)

32-K. Welding of Heat-Exchanger Elements in a Fast Breeder Reactor. S. H. Griffiths. *British Welding Journal,* v. 4, Sept. 1957, p. 403-411.

Argon arc welding process and radiographic and other inspection methods used in fabrication of heat exchangers from 18-8-1 stainless steel. (K1d, W13b, S13k)

33-K.* **Weldability of ND Steels.** L. Reeve. *British Welding Journal,* v. 4, Sept. 1957, p. 425-432.

Battelle and Reeve underbead cracking tests for weldability carried out on series of C-Mn steels including a number of notch ductile types. Results more in accordance with British carbon equivalent formula than Battelle formula for weldability. 7 ref. (K9s; AY)

34-K.* **Shielded Inert-Gas Metal-Arc Welding With Particular Reference to Welding Costs.** D. B. Tait. *British Welding Journal,* v. 4, Nov. 1957, p. 501-511.

Application of "sigma" process to Al alloys, stainless steel and mild steel. (K1d; Al, SS, CN)

35-K. Induction Brazing. W. E. Benninghoff. *Industry and Welding,* v. 30, Sept. 1957, p. 36-38, 64-67.

Principles and advantages of induction brazing, joint design, heating and alloy selection. (K8k)

36-K. It's Not So Tough to Weld Copper and Steel. *Industry and Welding,* v. 30, Sept. 1957, p. 53, 77.

Carbon-arc and phosphor-bronze welding rods used for welding mild steel legs to copper vessels. (K1h; Cu, ST)

37-K. No Threads, No Welds, Just Glue. Jack Schwartz. *Metalworking Production,* v. 101, Nov. 8, 1957, p. 2006-2007.

Epoxy resin ensures high joint strength in armor-piercing shot. (K12; NMd34; AY)

38-K. Copper Brazing. Thomas W. Ferguson, Jr. *Metal Treating,* v. 8, Sept-Oct. 1957, p. 6-7, 40, 44, 55.

The process, its advantages, preparation, assembling, applying brazed material, controlling Cu flow, atmosphere for furnace brazing, strength of joints and heat treatment of Cu brazed steel assemblies. (K8; ST, Cu)

39-K.* **New CO_2 Welding Process.** A. F. Chouinard and R. P. Monroe. *Welding Journal,* v. 36, Nov. 1957, p. 1069-1073.

Uses a bare flux-cored electrode and gives a high deposition rate, a visible arc and sound weld metal; suitable for welding low to medium-carbon steels and certain alloy steels. (K1d; ST)

40-K.* **Bonded Fluxes for Submerged-Arc Welding of Alloy Steels.** Hallock C. Campbell and Wallace C. Johnson. *Welding Journal,* v. 36, Nov. 1957, p. 1078-1084.

New type flux permits controlled variation of weld chemistry through incorporation in the flux of alloying elements, deoxidizers and strong fluxing agents, duplicating for submerged arc welding the whole range of formulation used by the covered-electrode manufactures. (K1e; SS, RM-q)

41-K.* **Experimental Welding With the Cone Arc.** R. E. Monroe and D. C. Martin. *Welding Journal,* v. 36, Dec. 1957, p. 518s-520s.

Electrical characteristics of the cone-arc welding process studied during development of welded Mo heat exchangers containing tube-to-header joints. Tests showed that the production of uniform welds was primarily a function of even heat transfer around the weld periphery. High-speed motion-picture studies of the arc failed to substantiate the basic cone-arc theory of a rotating ion beam. A modified theory is presented to explain the cone-arc process. 4 ref. (K1; Mo)

42-K.* **Selection of Welding-Rod Chemical Composition Through Mathematics.** G. H. Bohn. *Welding Journal,* v. 36, Dec. 1957, p. 541s-549s.

Procedure for determining the most satisfactory chemical composition for Cu-Si-Mn-Fe alloy welding rod. A mathematical formula was developed to determine the minimum resultant tensile strength of the weld as a function of the Si, Mn and Fe contents. The desired fluidity of the weld pool, to eliminate weld cracking, was obtained by maintaining the ratio of Si to Mn to an experimentally determined minimum. 6 ref. (K1, W29h, 2-60)

43-K.* **Heat-Exchanger Fabrication.** P. Patriarca, G. M. Slaughter and W. D. Manly. *Welding Journal,* v. 36, Dec. 1957, p. 1172-1178.

Tube-to-tube sheet welding and brazing procedures which have been incorporated into the fabrication of Ni-alloy heat exchangers for elevated-temperature service. Vessel portions of these units are assembled entirely by inert-arc welding procedures. (K1d, W13b; Ni)

44-K. A Satisfactory Base-Quality Steel for Both Riveted and Welded Structures. J. O. Jackson. *Welding Journal,* v. 36, Dec. 1957, p. 1184-1194.

Argues that specification ASTM A7 be revised to indicate that it is suitable for use in either riveted or welded structures, allowing the specified 60,000-psi. minimum tensile strength to remain, but adding a carbon limitation of 0.30% on ladle analysis up to a maximum permissible thickness for welded structures of 2 in. (K1, 15-68; ST)

45-K. Fluid-Cooled Honeycomb: Special Furnaces, Core Machinery Fabricate Brazed. *Western Metals,* v. 15, Nov. 1957, p. 50-51.

(K8j, W29m; 7-59)

46-K.* (Pamphlet.) **Brazing of Aluminum and Its Alloys.** 1957. 36 p. Aluminum Development Association, 33 Grosvenor Street, London, W.1, England. 2 sh.

Three main methods are flame, furnace and flux dip brazing. Suitable Al materials, fluxes, joint design, cleaning methods, fluxing and brazing procedures. (K8; Al)

47-K. (French.) **Cold Pressure Welding.** Robert Sathicq. *Revue de*

l'Aluminium, no. 246, Sept. 1957, p. 875-880.

Metallic parts are welded by a pressure exceeding the creep limit at room temperature after mechanical brushing. Any light metal can be welded with Al, and the process is very cheap. (K5; Al)

48-K. (French.) **Importance of Weldability of Aluminum Alloys in Ship Construction.** H. E. Jaeger. *Revue de la Soudure*, v. 13, 1957, p. 151-162.

Corrosion of Al alloys by salt water; the most corrosion resistant are Al-Mg; their weldability is very good. Comparison of riveting and welding; difficulties in the welding of light alloys. Distribution of steel and Al alloys in the construction of a ship according to the mechanical properties required. 13 ref. (K9s, R4b, T22g; 17-57; Al)

49-K. (French.) **Welding of "Schlieren" Bogies.** *Revue de la Soudure*, v. 13, 1957, p. 163-171. (K2h, T23p)

50-K.* (French.) **Contribution to the Study of the Influence of Hydrogen on the Strength of Deposited Metal in Arc Welding With Coated Electrodes.** M. Moneyron and D. Seferian. *Soudage et Techniques Connexes*, v. 11, Sept-Oct. 1957, p. 277-289.

Tests showed that loss of diffusible hydrogen at room temperature from an arc weld causes appreciable variation in weld strength. This variation can be partially or completely corrected by the presence of nitrogen imparted by electrodes containing this gas. Results obtained with basic, rutile, acid, oxidizing and cellulose electrodes. 12 ref. (K1, Q27a, W29h, 1-52; ST, *H*)

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51-K. (French.) **A Visit to Four Brissoneau and Lotz Plants.** *Soudage et Techniques Connexes*, v. 11, Sept-Oct. 1957, p. 290-294.

Welding processes and equipment used in fabrication of railway, aeronautic and water transport material in shops where product quality and economy are emphasized. (K general, 1-52, T23, T22, T24)

52-K.* (French.) **Arc and Flame Butt Welding of Ferritic Steel Boiler Tubes.** J. Hennion. *Soudage et Techniques Connexes*, v. 11, Sept-Oct. 1957, p. 323-332.

Comparison of characteristics of arc and flame welds made on tubes up to 90 mm. diameter and 9 mm. wall in Cr-Mo steel. Influence of preheating and heat treatments. Methods of heating and of inspection of welds. (K1, K2, K9p; ST, 4-60)

53-K. (German.) **Contribution to Welding of Titanium.** Helmut Van Kann. *Schweissen und Schneiden*, v. 9, Oct. 1957, p. 460-464. (CMA)

Neither tensile nor impact strength of Ti sheet in the neighborhood of the weld is impaired if the welding operation is conducted with the required care, the ductility on the other hand is lessened. 4 ref. (K general; Ti)

54-K. (Norwegian.) **Brazing of Aluminum Cables.** *Teknisk Ukeblad*, v. 104, Aug. 8, 1957. (In the Appendix *Naco-nytt*, v. 11, no. 45, p. 1-3.) (K8, T1b; Al)

Cleaning, Coating and Finishing

1-L. Science for the Coatings Technologist. Pt. 8. E. S. Beck *Metal Finishing*, v. 55, Nov. 1957, p. 50-55.

To be continued. (L26; 8-70)

2-L. Practical Metallizing of Technical Ceramics. Raymond C. Steffey. *Metal Finishing*, v. 55, Nov. 1957, p. 56-61.

Preparation of ceramic material for metallizing; applying the conducting film; firing or curing of the metallized pattern; kiln design; pattern spread and straining, electroplating; acid copper plating; acid tin plating; tinning; high-temperature metallizing. (L23, L17; NM-f)

3-L. How Corrosion Is Reduced on Landing Gear Pistons. William L. Aves, Jr. *Plating*, v. 44, Nov. 1957, p. 1175-1179.

Detailed method for applying Zn, Cu, Ni and Cr deposits to aluminum alloy landing gear pistons. Test results from corrosion panels. (L general, R3; Al, *Zn, Cu, Ni, Cr*)

4-L. Lead-Tin Alloy Plating for Aircraft Engine Components. Joseph Azzolino. *Plating*, v. 44, Nov. 1957, p. 1180-1182.

At Curtiss-Wright. (L17; Pb, Sn)

5-L. Vital Role of Plating and Pickling Techniques in the Aircraft Industry. Sam A. Long. *Plating*, v. 44, Nov. 1957, p. 1183-1185.

Techniques at Bell Aircraft. (L12g, L17)

6-L. Practical Aspects of Aluminum Hardcoating. A. W. Sweet. *Plating*, v. 44, Nov. 1957, p. 1191-1196.

Hardness, wear corrosion and abrasion resistance; hard coating equipment; processing details; finished hard coated parts. (L24; Al)

7-L. Antigalling Coatings and Lubricants for Titanium. E. L. White, P. D. Miller and R. S. Peoples. Battelle Memorial Institute, Titanium Metallurgical Laboratory, Report 34. *U. S. Office of Technical Services*, PB 121610, Feb. 1956, 54 p. (CMA)

A survey of methods of reducing the galling type of wear indicates that the bare metal cannot be satisfactorily lubricated. Satisfactory wear performance can be obtained by use of coatings of various kinds plus suitable lubricants. Coatings investigated were oxide, nitride and case hardening; metallic, including Cr, Al, Cu and Ni; and chemical conversion, including phosphate, fluoride-phosphate and anodized coatings. The most successful lubricants tested were of the fluorocarbon type. (L general, Q9; Ti, NM-h)

8-L. (French.) **Electrolytic Deposits of Rhodium.** *Galvano*, v. 26, Sept. 1957, p. 27-36.

Comparative merits of sulphate and phosphate solutions; barrel coating; applications of rhodium coatings in decorative field; mechanical, physical and optical properties of Rh; formulas for coating solutions; removal of Rh deposits. (L17; *Rh*)

9-L. (Italian.) **Anodic Polychrome Oxidation by the Silk Screen Process.** *Alluminio*, v. 26, Sept. 1957, p. 383-389.

Principles of silk-screen printing; step-by-step procedure for smooth, engraved and raised designs in two, three or more colors; inks and their characteristics; practical hints on printing and engraving techniques, solutions. Excellent results on superpure Al and "Reflectal" alloys. 6 ref. (L26b; Al)

10-L. Automatic Resurfacing of Steel-Mill Rolls by Welding. A. Smarcan. *Brown Boveri Review*, v. 44, June-July, 1957, p. 276-285.

Causes of wear; methods of reconditioning mill rolls; shape and material of rolls; electrode material; surfacing process; shop procedure for roll reconditioning; installations in which automatic arc welders are being used. (L24, W23k)

11-L. These Aluminum Enamels Resist Corrosion by Boiling Alkaline Water. B. W. King, W. H. Duckworth, John Schultz and H. P. Tripp. *Ceramic Industry*, v. 69, Oct. 1957, p. 82-85.

Enamels for 2S Al were developed with corrosion rates about 1/75 that of base Al in boiling alkaline water for 100 hr. Enamels are based on Na_2O-PbO-SiO_2 eutectic composition, with substitutions of a total of 10 to 15% of TiO_2, ZrO_2 and alkaline earth oxides for PbO and Na_2O. About 1% NiO was beneficial for promoting adherence. (L27, R4f; Al)

12-L. What Every Aluminum Enameler Should Know. Paul A. Huppert. *Ceramic Industry*, v. 69, Oct. 1957, p. 86-87.

De-enameling technique, dangers of repeated firing, toxicity of materials used in pre-enameling and enameling process, toxicity of finished products, uses of reclaimed enamels, housekeeping in enameling plants. (L27; Al)

13-L. Protection of a Sulphonating Plant. T. P. Barling. *Corrosion Prevention and Control*, v. 4, Oct. 1957, p. 61-63.

Corrosion prevented by resin-based paints. (L26p)

14-L. Wetting Agents in Metal Treatment. J. K. Aiken and D. K.

Howard. *Corrosion Technology,* v. 4, Sept. 1957, p. 318-319, 332.

Wetting agents for use in acid pickling, alkaline cleaning, electroplating, phosphating or other metal treating solutions. (L12, L14b, L17)

15-L. Polytetrafluoroethylene Dispersions for Metal Finishing. E. M. Elliott. *Institute of Metal Finishing, Transactions,* v. 33, 1955-1956, p. 355-369.

Applied by brushing, dipping, but more generally by spray coating. Surfaces have high heat resistance, low coefficient of friction, anti-adhesive properties and reasonable resistance to chemical attack. Toxic fumes are given off during processing. 9 ref. (L26p)

16-L. Experiences and Problems in the Surface Treatment of Die-Castings. Pt. 2. Cleaning, Painting, Chemical Treatments. W. Ruegg. *Metal Industry,* v. 91, Nov. 1, 1957, p. 375-377.

(To be continued.) 13 ref. (L12, L26; 5-61)

17-L. Chromium Gives New Life to Crankshafts. Plating With Chromium Stands up Under Heavy Service. *Modern Railroads,* v. 12, Oct. 1957, p. 115-116.

In diesel locomotives. (L17; *Cr*)

18-L. (German.) **Galvanizing of Aluminium.** H. W. Dettner. *Aluminium,* v. 32, Oct. 1957, p. 665-668.

Oxide films which cause difficulty in galvanizing are dissolved and replaced by a film of Cu, Zn, Ni or Fe, deposited by ion exchange, as a basis for adhesion of other metal coatings. 25 ref. (L16; Al, *Zn*)

19-L. (German.) **New High-Speed Method for Hot Tin Plating of Thin Copper Wires.** O. Haugwitz. *Draht,* v. 8, Aug. 1957, p. 336-339.

New machine has speeds up to 5500 ft. per min. high speed, which leads to cost-reduction, is dependent on cleanness of wire surface, pickling agent, wire diameter, bath temperature. (L17, 1-52; Cu, *Sn,* 4-61)

20-L. (German.) **Exhaust and Sealing Hoods Over Chemical Baths for Surface Treatment of Metals.** G. W. Mazurzak. *Draht,* v. 8, Aug. 1957, p. 344-349.

Wire pickling installations can be improved through reduction of the surface contact between bath and outside air. 6 ref. (L12g; 1-52; ST, 4-61)

21-L. (German.) **Centrifugal Polishing.** E. Knuth-Winterfeldt and Ulf Langer. *Metalloberfläche,* v. 11, Aug. 1957, p. 253-254.

Steel specimens to be polished were subjected to a chemical treatment in a mixture of oxalic acid and hydrogen peroxide and then were centrifuged. Advantages are faster polishing, lower temperatures and less pitting. (L10b; ST)

22-L. (German.) **Interruption of Zinc Plating.** H. Bablik, F. Gotzl and E. Nell. *Metall,* v. 11, Aug. 1957, p. 649-651.

Frequently shadows appear on the surface after zinc plating. In these zones zinc-iron alloys rather than pure zinc constitute the surface layer. The reaction speed between iron and zinc is higher than normal resulting in the absorption of the pure zinc layer during and after plating. Unfavorable rolling conditions can also be blamed. Possible remedies are pickling of the unplated iron sheets and addition of aluminum to the zinc bath. 3 ref. (L17; *Zn*)

23-L. (German.) **Effects of Ball Polishing in Surface Treatment.** M. Dreher. *Metall,* v. 11, Sept. 1957, p. 752-754.

Materials, form of pieces, surface roughness and surface treatment before polishing; length of polishing operation; obtainable surface finish; economics of the process. 4 ref. (L10d)

24-L. (German.) **On the Nature, Composition and Electrical Properties of Oxide Coatings on Electrolytic Condensers.** L. Holik and H. Nowotny. *Metall,* v. 11, Sept. 1957, p. 737-740.

Differences in the nature of oxide coatings on Al foils after electrochemical oxidation in relation to initial conditions and the process of formation. Properties of crystallized gamma and amorphous oxides. 6 ref. (L14a, P15; Al, 4-56)

25-L. (German.) **Chemical Surface Protection of Light Metal.** A. Pollack. *Metall,* v. 11, Sept. 1957, p. 754-756.

Chemical surface protection is preferred to electrochemical processes; it is simpler and more economical and affords good protection against corrosion when used as a base for lacquer coatings. 17 ref. (L14; Al, Mg)

26-L. (German.) **Electrolytic Polishing of Metals.** H. Mohlberger. *Metall,* v. 11, Sept. 1957, p. 756-761.

Influence of the flow velocity of the electrolyte upon the form of the ampere-voltage curves and their interpretation; electrolytic polishing of copper and brass in phosphoric acid; theories on the mechanism of metal brightness. 29 ref. (L13p)

27-L. (German.) **Present State of Electroplating.** Willibald Machu. *Stahl und Eisen,* v. 77, Oct. 3, 1957.

Surface preparation, pickling, grinding, polishing, rectifiers, baths. 77 ref. (L17, L general)

28-L. (German.) **Spent Pickling Solutions.** Kurt Mathesius. *Stahl und Eisen,* v. 77, Oct. 3, 1957, p. 1349-1355.

Methods of recovering suphuric acid, conversion to iron sulphatemono and heptahydrate; mechanical descaling; consumption of sulphuric acid in the iron industry. 14 ref. (L12g, A8b)

29-L. (German.) **Acid Copper Plating and the "Cupatier" Process.** W. Strauss and E. Roth. *Metalloberfläche,* v. 11, Sept. 1957, p. 281-285.

Very bright copper finishes can be obtained by lowering the working temperature, increasing the suphuric acid content in the electrolyte, increasing the current density, selection of suitable inhibitors. Surface hardness, ductility and corrosion resistance were improved, permitting direct copper plating of iron. Working procedures. 8 ref. (L17, Fe, *Cu*)

30-L. (German.) **Problem of Current Distribution in Concentrated Electrolytes.** P. Csokan. *Metalloberfläche,* v. 11, Sept. 1957, p. 285-288.

A new method for observing current distribution. (To be continued.) (L17)

31-L. (German.) **The "Kolene" Process—a Salt Bath Process for Cleaning Metal Surfaces.** K. Falkenmayer. *Metalloberfläche,* v. 11, Sept. 1957, p. 297-304.

Descaling of hot and cold formed pieces, removal of sand and graphite residues from castings, stripping of paint. 21 ref. (L12n)

32-L. (Russian.) **Effect of Galvanizing in Cyanide Electrolyte on Mechanical Properties of Steels.** I. I. Moroz and N. I. Kudryatsev. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1957, p. 28-33.

Tough steels are subjected to a greater degree of change than softer ones. This may be explained by the tougher steel's absorbing more hydrogen from the electrolyte. (L16, Q general; ST, *Zn*)

33-L. (Russian.) **Galvanizing With Zinc Phosphate Electrolyte.** A. V. Rikova and E. I. Rudoi. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1957, p. 33-37.

The zinc coating obtained has strong anti-corrosion properties and may be used as an undercoating for Cr plating. (L16, *Zn*)

34-L. (Russian.) **Surface Boronization of Low-Alloy Steels.** V. D. Taran and L. P. Skurova. *Metallovedenie i Obrabotka Metallov,* no. 6, June 1957, p. 45-47.

Quality of the boronized layer depends on the temperature of the electrolyte and duration of the treatment. 6 ref. (L17; AY, *B*)

35-L. (Russian.) **Tin Economy in Production of White Tinplate.** M. S. Arkhipova, V. D. Mishin and N. S. Smirnov. *Metallurg,* v. 2, July 1957, p. 30-34.

Three original methods of tin recovery in tinplating. (L17, A11d; Sn)

36-L. Multi-Roller Burnishing: Short Cut to a Fine Finish. M. J. Delany, Jr. *American Machinist,* v. 101, Oct. 21, 1957, p. 156-159.

(L10b)

37-L. At 3000 F. . . . CRS + Chromecase Outlasts Stainless Steel 5 to 1. William M. Stocker, Jr. *American Machinist,* v. 101, Nov. 18, 1957, p. 162-163.

Heat resistance for searchlight parts is achieved by diffusing Cr into the surface. (L15; 8-22; Cr)

38-L. Coating Technique Gets a Boost: New Process Uses Electrophoretic Deposition, Gives a Hard, Bright Molybdenum Coating. *Chemical and Engineering News,* v. 35, Dec. 2, 1957, p. 48.

(L19p; Mb, *SS, Ni*)

39-L. The British Iron and Steel Research Association. Pt. 2. Protective Measures. J. C. Hudson. *Corrosion Technology,* v. 4, Oct. 1957, p. 349-353, 362.

Evaluation of methods for protecting steel structures from atmospheric corrosion; priming paints and effect of film thickness, conditions of application, meteorological conditions; protection by metallic coatings. (L26n, L general; ST)

40-L.* Electroplating From the Pyrophosphate Bath. Pt. 1. Electrodeposition of Single Metals. T. L. Rama Char. *Electroplating and Metal Finishing,* v. 10, Nov. 1957, p. 347-349.

Sn, Cu, Zn, Ni and Pb can be satisfactorily plated from pyrophosphate solutions; optimum operating conditions. The bath may also be useful for the electrodeposition of Co and Fe and possibly of other metals. 29 ref. (L17a; Sn, Cu, Zn, Ni, Pb)

41-L. Compressed Air and Its Application in Metal Finishing. James Robertson. *Electroplating and Metal Finishing,* v. 10, Nov. 1957, p. 366-373.

Supply and distortion of compressed air. (To be continued.) (L general, 1-52, 1-71)

42-L.* Enamelling of Aluminium. A. Biddulph. *Foundry Trade Journal,* v. 103, Nov. 21, 1957, p. 603-608.

Enameling of sheet and castings. Basic requirements; metal preparation; oxidizing; procedure to follow when treating castings; milling of enamels and their application; drying; fusing; and enamel composition. (L27; Al)

43-L. Test Hard Surfacing Materials Yourself. D. B. Rankin. *Industry and Welding,* v. 30, Sept. 1957, p. 46-47, 67.

Suggestions for choosing and welding hard surfacing alloys. (L24)

44-L. Cladding on Carbon Steel Opens New Field to Titanium. R. C. Bertossa. *Iron Age,* v. 180, Oct. 31, 1957, p. 59-62. (CMA)

Cladding via a special adaptation of vacuum-furnace brazing. (L22, K8; ST, Ti, *Li*)

45-L.* Spraywelding—a Hard Facing Preventive Maintenance Process. J. R. Smith. *Iron and Steel Engineer,* v. 34, Sept. 1957, p. 90-95.

Preparation of surface to be treated, spraying the surface with metal powder, fusing the overlay by means of controlled atmosphere furnace or oxy-acetylene torch, mechanical properties of Ni-base alloys used as spray-weld overlay, advantages and metals which may be spray welded. (L24; Ni)

46-L. Silicon Protective Coatings for the Steel Industry. R. C. Hedlund. *Iron and Steel Engineer,* v. 34, Sept. 1957, p. 109-112.

Silicon resin-base finishes excel where heat, weather or moisture resistant coating is needed for protection of industrial structures. (L26c)

47-L. Weirton Steel Places Additional New Facilities Into Operation. *Iron and Steel Engineer,* v. 34, Nov. 1957, p. 148-155.

New continuous cleaning and annealing line in the tin mill department and a new continuous coil galvanizing line at Weirton Steel Co. (L12, L16, J23; ST, *Zn*)

48-L. Gage Tightens Control of Wire Coating Process. *Iron Age,* v. 180, Nov. 21, 1957, p. 132-133.

(L26p, S14, 4-11; Cu)

49-L. Titanium Plating—Where It Stands Today. M. E. Sibert and M. A. Steinberg. *Materials in Design Engineering,* v. 46, Nov. 1957, p. 132-133. (CMA)

Titanium plate on base metals is a method of using the corrosion resistance of titanium while avoiding its high cost. Fused salt electrodecomposition and fused salt soluble anode methods give good plates. (L17; Ti)

50-L. Science for the Coatings Technologist. Pt. 8. Green Pigments. E. S. Beck. *Metal Finishing,* v. 55, Nov. 1957, p. 50-55.

(To be continued.) (L26n)

51-L.* Practical Metallizing of Technical Ceramics. Raymond C. Steffey. *Metal Finishing,* v. 55, Nov. 1957, p. 56-61.

Preparation of ceramic material for metallizing; applying the conducting film; firing or curing of the metallized pattern; kiln design; electroplating of ceramics, acid Cu and acid Sn plating; high-temperature metallizing. (L23; 6-70)

52-L. Effective Current Density. J. B. Mohler. *Metal Finishing,* v. 55, Nov. 1957, p. 71.

In electroplating. (L17b)

53-L.* Experiences and Problems in the Surface Treatment of Die-Castings. Pt. 3. Electrolytic Processes. W. Rüegg. *Metal Industry,* v. 91, Nov. 15, 1957, p. 422-424.

Electrolytic degreasing; Cu strike baths; bright Cu baths; rinsing and pickling, at Injecta Ltd., Teufenthal, Switzerland. (To be continued.) 10 ref. (L12, L13, L17; 5-61)

54-L.* Electroforming of Telephone Drop Wire Conductor. Robert J. Bachman. *Metal Progress,* v. 72, Nov. 1957, p. 88-92.

Conductance is precisely measured and thickness of metal deposition is controlled as steel wire is coated with Cu, Pb and brass at the rate of 100 ft. per min. (L17, T1b, 17-57; ST, Cu)

55-L. Electroforming of Linear Accelerator Structures. James A. Pope. *Plating,* v. 44, Dec. 1957, p. 1291-1296.

Equipment and techniques used at Stanford University. (L18)

56-L.* Studies on Electroless Nickel Plating. Clara H. de Minjer and Abner Brenner. *Plating,* v. 44, Dec. 1957, p. 1297-1305.

The rate of deposition increased with the pH of the bath, and varied with the nature of the acid used for buffering or complexing of Ni ions. Nickel phosphite precipitated from the bath more readily at higher values of pH. Outdoor exposure tests were made of steel plated with electroless Ni and with electrolytic deposits of Ni and Ni-P alloy. The electroless deposits and the electrolytic Ni-P alloys gave better protection than electrodeposited Ni. 14 ref. (L28; Ni)

57-L. Here Are Advantages of Conversion Coatings. *Precision Metal Molding,* v. 15, Dec. 1957, p. 54-55, 57.

Inorganic films produced on metallic surfaces by chemical reactions with an analysis of the corrosion protection afforded. (L14; ST)

58-L. Pickling Stainless to Remove Scale. W. E. McFee. *Steel,* v. 141, Nov. 25, 1957, p. 103-107.

Seven treatments for varying degrees and types of scale. (L12g; SS)

59-L. New Method to Clean Moly. *Steel,* v. 141, Nov. 18, 1957, p. 158. (CMA)

The first step is a 5-10 min. immersion in an acidic permanganate bath at 150-180° F. to further oxidize the oxides, which are then removed by pressure spray. The second step is a 5-10 min. immersion in an acidic chromate bath to remove the residual smut. (L12g; Mo)

60-L. Formation Fields and Current Efficiencies in the Anodic Oxidation of Zirconium. A Direct Comparison of High-Potential Formation Fields With Those Derived From Low-Potential Changing Curves. G. B. Adams, Jr., Tien-Shuey Lee and Pierre Van Rysselberghe. *U. S. Atomic Energy Commission,* AECU-3500, 1957, 33 p. (CMA)

9 ref. (L19; Zr)

61-L. (Pamphlet.) **Uses of Ceramic-Coated Metals in Small Plants.** Frederick D. Shaw. Small Business Administration. Technical Aids for Small Manufacturers. U. S. Government Printing Office, Washington 25, D. C., July 1957, 4 p.

(L27, 17-57)

62-L.* (German.) **Mechanical Descaling for Steel Bars and Semifinished Steel.** Fritz Schweitzer. *Stahl und Eisen,* v. 77, Oct. 1957, p. 1476-1482.

Different types of shot-blasting; blasting media, cost, defects; wear problems; economic and qualitative results on steel bars and semi-finished special steels. (L10c; ST, 4-55)

63-L. (French.) **Influence of the pH of Metallic Surfaces on Paint Adherence.** Claude Hess. *Peintures, Pigments, Vernis,* v. 33, Sept. 1957, p. 798-800.

Types of soil and foreign matter found on untreated surfaces; methods of removal; importance of final rinsing; characteristics of final rinsing bath. (L26)

64-L. (French.) **Electrolytic Oxidation and Galvanic Deposition on Titanium.** H. Richaud. *Revue de Métallurgie,* v. 54, no. 10, 1957, p. 787-792. (CMA)

Effect of various factors (potential, temperature, duration, nature of the electrolyte) on anodic and cathodic treatment of Ti. Formation of oxide layers is a function of time and current density. A natural oxide film on Ti necessitates a preliminary treatment of the surface before electrolytic deposition. (L19; Ti)

65-L.* (French.) **Special Application of Oxy-Acetylene Flame Descaling to the Preparation of Commercial Rolling Mill Products for Spot Welding.** M. Evrard. *Soudage et Technique Connexes,* v. 11, Sept-Oct. 1957, p. 297-317.

Flame heating followed immediately by water-spray cooling eliminates scale and provides necessary surface condition for welding. Influence of flame descaling on mechanical properties and structure of the metal and of spot welds made on steel plate thus treated. 16 ref. (L10g; ST, 4-53)

66-L. (Japanese.)**Anodic Oxidation of Titanium. Pt. 1.** Hisaya Nagasaki and Haruo Ishida. *Light Metals (Tokyo),* no. 25, July 1957, p. 79-85. (CMA)

TiO_2 formed by anodic oxidation is not yet useful as an electrolytic capacitor because it is unstable and current leakage is large. Although aqueous solutions of various salts were used in the anodic oxidation, no stable oxide was formed. A salt bath of 45% $NaNO_3$ and 55% KNO_3 at 250-350° C. and a constant current method gave a film with a low leakage current, a crystallized film with large grains, and significant charge and discharge characteristics. The relationship between capacity, resistivity and voltage of formation was not perfectly linear, and a discontinuity occurred at 35-40 volts. 6 ref. (L19; Ti)

67-L.* (Roumanian.) **Mechanism of Porous Chromium Plating. Pt. A. Study of Porosity.** I. Firoiu. *Revista de Chimie,* v. 8, July 1957, p. 471-479.

Porosity of coatings deposited on steel and copper specimens was studied in terms of density of cathodic current, cathodic processing temperature, concentration of chromic acid, CrO_3/SO_4 ratio, trivalent Cr concentrations, density of anodic current, duration and temperature of anodic processing. Deposits were examined by microscope. 19 ref. (L17, P10m; ST, Cu, *Cr*)

68-L.* (Roumanian.) **Mechanism of Porous Chrome Plating. Pt. B. Study of Internal Stresses.** I. Firoiu. *Revista de Chimie,* v. 8, Sept. 1957, p. 574-579.

Internal stresses in steel and copper specimens as influenced by density of cathodic current, bath temperature, concentration of chromic acid. 12 ref. (L17, Q25; *Cr*)

Metallography

Constitution and Primary Structures

1-M. Hydrogen-Uranium Phase Diagrams. M. W. Mallett and M. J. Trzeciak. *First Nuclear and Engineering Science Congress*, v. 1, 1957, p. 168-169.

Recent solubility data were used to prepare diagrams based on terminal solubilities and solubilities at 1 atm. hydrogen pressure. (M24b, U, H)

2-M. Investigation of Nitride Precipitates in Pure Iron and Mild Steels. G. R. Booker, J. Norbury and A. L. Sutton. *Iron and Steel Institute, Journal*, v. 187, Nov. 1957, p. 205-215.

Iron nitride precipitates present in openhearth steel slabs, in a range of nitrided steels, and in nitrided pure iron have been isolated by an extraction replica method, and have been examined by electron microscopy, electron diffraction and X-ray diffraction. Two types of precipitate have been observed and their platelike nature demonstrated. 20 ref. (M26r; Fe-a, CN)

3-M. Metallographic Examination of Glassed Titanium Specimens. M. L. Picklesimer. *U. S. Atomic Energy Commission*, CF-56-5-141, May 18, 1956, 7 p. (CMA)

The firing temperature was within the temperature range of the alpha + beta field of the metal, causing the formation of beta-phase on cooling to room temperature or decomposition to an alloy-rich alpha-phase. Some reaction between the glass and the metal surface probably occurred, but apparently was not serious or detrimental. (M27, N6p; Ti)

4-M. (English.) Investigation on the Titanium-Iron-Carbon System. Yotaro Murakami, Hirozo Kimura and Yoshio Nishimura. *Kyoto University, Faculty of Engineering, Memoirs*, v. 19, July 1957, p. 302-319. (CMA)

Solid solubility ranges of TiFe and $TiFe_2$ in the Ti-Fe system are 52-54% Fe at 1080° C. and 69-77% Fe at 1200° C. In the Ti-Fe-C system there occur α-Ti, β-Ti, graphite, δ-phase, TiFe, $TiFe_2$, α-Fe and δ-Fe. Crystal structure, lattice parameters and liquidus surface. 13 ref. (M24c; Ti, Fe, C)

5-M. (Russian.) Phase Transformations in the System Iron-Chromium-Vanadium. I. I. Kornilov and N. M. Matveeva. *Zhural Neorganicheskoi Khimii*, v. 2, Feb. 1957, p. 355-366. (CMA)

High-temperature quenched alloys, which are ternary ferrite-containing solid solutions, transform on annealing into brittle, nonferromagnetic alloys containing sigma phase. The temperature of the alpha-sigma transformation rises continuously from 868° C. (FeCr) to 1225° C. (FeV). This points to the existence of a continuous series of solid solutions involving the two compounds. 9 ref. (M24c; Fe, Cr, V)

6-M. (Russian.) Study of Alloys of the System Iron-Chromium-Nickel-Tungsten-Titanium-Aluminum. V. S. Mikheev. *Zhural Neorganicheskoi Khimii*, v. 1, Sept. 1957, p. 2110-2117. (CMA)

The six-component diagram was examined in cross sections passing through the point 1.5% Ti and various points between the limits 20-50% Ni and 1.5-8% Al. Effect of changes in Ni and Al content on properties of these alloys, mainly in the region of austenitic solid solutions. 14 ref. (M24d; Fe, Cr, Ni, W, Ti; Al)

7-M. (German.) Surface of Zinc After Various Treatments. K. Huber and D. Laske. *Metalloberfläche*, v. 11, July 1957, p. 217-225.

Coatings on Zn as formed in air, water or solutions examined with electron microscopic and diffractographic methods. Both reflected and penetrating beams are utilized after proper preparation of specimens. The coatings are found to be zinc oxides with variable structures depending on the treatment and on whether the specimen was prepared from the inside or outside of the coating. 5 ref. (M26r, R1h; Zn)

8-M. (German.) Examination of Surface by Electron Emission Microscopy. E. B. Bas. *Planseeberichte für Pulvermetallurgie*, v. 5, Aug. 1957, p. 42-52.

Principle of the emission microscope, the obtainable resolution and interpretation of photographs; preparation of specimens; molybdenum carbide used as example for the various applications of the instrument. (M21e, 1-53)

9-M. (Japanese.) Microscopic Study of Etched Germanium Surfaces. Pt. 2. M. Kikuchi and S. Iizima. *Electrochemical Laboratory, Bulletin (Denki Shikenjo Iho)*, v. 21, July 1957, p. 481-482, + plates.

Etch pits produced by various etchants; discussion of dislocations, small angle grain boundary. (M20q, M21c; Ge, 14-61)

10-M. (Polish.) Brittleness of Transformer Steel Plate. F. Khol. *Hutnik*, v. 24, July-Aug. 1957, p. 295-299.

Investigation of plate structure using electron microscope; characteristics of inclusion formation on the grain border causing brittleness. (M27f, Q26s; SGA-r, AY)

11-M. (Russian.) Electron-Microscope Investigation of the Structure of 1X18N9 Steel After Various Heat Treatments. E. I. Kvashnina. *Metallovedenie i Obrabotka Metallov*, no. 5, May 1957, p. 35-38.

Structure changes connected with mechanical properties resulting from various heat treatments. (M27, 2-64, Q general; AY)

12-M.* Metallography of Powder-Powered Fastenings in Mild Steel. C. J. Osborn and N. E. Ryan. *Australian Institute of Metals, Journal*, v. 2, Aug. 1957, p. 48-53.

Metallographic study of microstructures occurring at interface between mild steel plate and carbon steel fasteners driven into place by explosive charge. 7 ref. (M27f; CN, 7-53)

13-M.* Study of the Deformed Layer Produced on Metal Surfaces by Mechanical Machining, Abrasion and Polishing Operations. L. E. Samuels. *Electroplating and Metal Finishing*, v. 10, Sept. 1957, p. 279-282, 285.

Metallographic structures and depth of deformed surface layers produced in specimens of 70:30 brass, austenitic steel and Zn by various metallographic machining, abrasion and polishing treatments. Methods of producing strain-free surfaces by electrolytic or mechanical polishing. (To be concluded.) (M27, M20p, K17)

14-M.* Some Metallographic Observations on the Fatigue Behaviour of Copper and Nickel and Certain of Their Alloys. C. A. Stubbington and P. J. E. Forsyth. *Institute of Metals, Journal*, v. 86, Oct. 1957, p. 90-94.

Formation of local soft spots in specimens subjected to cyclic stress. Extension phenomenon has been observed in electrolytic Cu fatigued in the annealed condition at room temperature and in stable solid solutions and pure metals cold worked before cyclic stress. Monel fatigued in the annealed condition at 300° C. reveals a difference in etching characteristics between regions exhibiting slip-band extrusion and the matrix. 6 ref. (M27, M26s, Q7; Cu, Ni)

15-M.* Aluminium-Rich Alloys of the Quaternary System Aluminium-Iron-Copper-Nickel. G. V. Raynor and B. J. Ward. *Institute of Metals, Journal*, v. 86, Nov. 1957, p. 135-144.

The constitution of the Al-rich alloys of the quaternary Al-Fe, Cu, Ni system in the solid state at 530° C. examined by metallographic, X-ray diffraction and electrode-potential measurements. Results in relation to the more recent suggestions with regard to the general nature of Al-rich intermetallic compounds formed by Al and transition metals of the first long period of the periodic table. 20 ref. (M24d; Al, *Fe, Cu, Ni*)

16-M.* Extraction of Minor Phases From Austenitic Steel. J. F. Brown, W. D. Clark and A. Parker. *Metallurgia*, v. 56, Nov. 1957, p. 215-223.

Electrolytic solution has been used as a means of concentrating minor phases in complex alloys. Results on a variety of austenitic steels extracted with six electrolytes. A series of 18-8-Ti and 18-8-Cb steels was examined to find the effect of heating at 500-900° C. for up to 500 hr. on the phases present. Chromium carbide is found in all these steels but with longer times of heating is replaced by sigma. 13 ref. (M20q, 2-62; SS; *Ti, Cb*)

17-M. Electron Microscopy of Tin Whiskers Using Carbon Replicas. D. E. Bradley, J. Franks and P. E. Rush. *Physical Society Proceedings*, Section B, v. 70, Sept. 1, 1957, p. 889-892.

Study of shape and surface structure revealed cylindrical whiskers, coarsely ridged types, ribbon formations and numerous more complex shapes. No straightforward hexagonal or cubic rods were found. 5 ref. (M21e; Sn, 14-61)

18-M.* Crystal Structure Changes in the Tau Phase of Aluminum-Copper-Nickel Alloys. S. S. Lu and T. Chang. *Scientica Sinica*, v. 6, June 1957, p. 431-462.

X-ray investigation of ternary phase tau. Systematic structure changes are found in single phase field of tau, which occupies extensive area in isothermal section of phase diagram at room temperature. There are eight types of structures, all derived from a basic rhombohedron with corners occupied by Al atoms and centers either occupied by the

heavy atoms or remaining vacant. Change of structure types follows closely Ni or Cu content for alloys of constant Al content, atomic size factor appearing to be unimportant in formation of these alloys. For alloy phase of defect lattice type, most fundamental factor controlling formation of structures is average number of valency electrons per basic structural unit. Average number of valency electrons remains remarkably constant throughout entire phase field, while electron composition varies with composition. 13 ref. (M26; Al, Cu, Ni)

19-M. Titanium-Germanium System From 0 to 30% Germanium. V. C. Petersen and R. W. Huber. *U. S. Bureau of Mines, Report of Investigations* 5365, Oct. 1957, 20 p. (CMA)

(M24b; Ti, Ge)

20-M.* A New Nickel-Boron Phase Diagram for Brazing-Alloy Development. G. S. Hoppin, III. *Welding Journal,* v. 36, Dec. 1957, p. 528s-530s.

New determination of the phase relationships in the Ni-rich end of the system. A partial phase diagram is presented. The eutectic temperature was found to be 1980° F., or 100° F. lower than the value previously known. A small region of solid solubility of B in Ni was also found. Development and application of Ni-base high-temperature brazing alloys containing B. (M24b; SGA-f, Ni, *B*)

21-M.* (French.) Charging of Iron in Cathodic Hydrogen in Presence of Sodium Sulphide. Simone Besnard, Riccardo Santini and Jean Talbot. *Comptes Rendus,* v. 245, Sept. 9, 1957, p. 965-966.

Micrographic study of electrolytic Fe showed that in addition to appearance of bubbles distributed uniformly over the metal during charging in absence of SNa_2, there also occurs a more or less continuous widening of grain boundaries, which affects mechanical properties of Fe. These effects can be corrected by annealing at 850° C. in pure, dry hydrogen, as a result of which grain boundaries regain normal appearance but bubbles remain. Boundary phenomenon is probably due to introduction of sulphur into metal during charging. 3 ref. (M27f, C23p; Fe)

22-M. (German.) Contribution to the Knowledge of the System Titanium-Gallium. Kurt Anderko and Ulrich Zwicker. *Naturwissenschaften,* v. 44, no. 19, 1957, p. 510. (CMA)

5 ref. (M24f; Ti, Ga)

23-M. (German.) Note on Titanium Hydride Formed by the Reaction of Titanium With Acids. S. Yamaguchi and R. Otsuka. *Zeitschrift fuer anorganische und allgemeine Chemie,* v. 291, Sept. 1957, p. 131-133. (CMA)

(M26r, R6b; Ti)

24-M. (German.) Electron Emission Microscopic Study of the Carburization of Molybdenum From a Gaseous Phase. E. B. Bas, Willfried Epprecht and Lucien Preuss. *Zeitschrift fuer Metallkunde,* v. 48, Sept. 1957, p. 516-522.

5 ref. (M21g, J28g, N1; Mo)

25-M. (Japanese.) Phase Diagram of FeO-TiO_2 and Fe_2O_3-TiO_2 System. Tesura Yoshida and Takeshi Takei. *Electrochemical Society of Japan, Journal,* v. 25, Aug. 1957, p. 423-427. (CMA)

The two Fe oxide-titania systems were studied to throw some light on the nature of titaniferous sands. 5 ref. (M24d; Fe, Ti, O)

26-M. (Japanese.) On the Corrosion Resistance of Titanium Alloys. Pt. 2. The Equilibrium Diagram of the Titanium-Platinum System. Hideo Nishimura and Tsuyoshi Hiramatsu. *Japan Institute of Metals, Journal,* v. 21, July 1957, p. 469-473. (CMA)

(M24, R general; Ti, Pt)

27-M. (Japanese.) Cored Structure of Magnesium-Zirconium Alloy. Shotaro Morozumi and Tomoyuki Takeuchi. *Light Metals,* v. 7, July 1957, p. 75-78.

Annealed structures and mechanism of formation of cored structures. 7 ref. (M27, M26q; Mg, Zr)

28-M. (Russian.) Interaction Between Titanium Carbide and Metals of the Iron Family. V. N. Eremenko. *Zhurnal Neorganicheskoi Khimii,* v. 1, Sept. 1956, p. 2131-2148. (CMA)

Phase diagrams of the systems Ni-TiC, Co-TiC and Fe-TiC. 38 ref. (M24c; Ti, Ni, Co, Fe, C)

29-M. (Russian.) Study of Solubility of Titanium and of the Phase Composition of Alloys in the Five-Component System Nickel-Chromium-Tungsten-Aluminum-Titanium. I. I. Kornilov, A. Ya. Snetkov and F. M. Titov. *Zhurnal Neorganicheskoi Khimii,* v. 2, Jan. 1957, p. 160-166. (CMA)

14 ref. (M24d; Ti, Ni, Cr, W, Al)

30-M. (Russian.) Non-Isomorphic Structures in Iron Alloys Containing Molybdenum and Tungsten. D. F. Zhirnov, N. F. Lashko and K. P. Sorokina. *Zhurnal Neorganischeskoi Khimii,* v. 1, Nov. 1957, p. 2588-2589. (CMA)

(M26; Fe, Mo, W, *Ni, Cr*)

N Transformations and Resulting Structures

1-N. Diffusion of Uranium Through Graphite. L. D. Loch, J. R. Gambino and W. H. Duckworth. *First Nuclear Engineering and Science Congress,* v. 1, 1957, p. 145-150.

Diffusion rates were determined in the range 3000 to 4350° F. The diffusion couples consisted of sintered UC_2 disks in contact with graphite rods. Two distinct types of uranium transport could be associated with volume diffusion and with migration along pores. 4 ref. (N1, 2-62; U, NM-k36)

2-N. Effect of Hydrogen Upon Martensite Formation in Low-Alloy Steels. R. Kumar and A. G. Quarrell. *Iron and Steel Institute, Journal,* v. 187, Nov. 1957, p. 195-204.

Metallographic method chosen was the quench-temper technique followed by quantitative evaluation of martensite formed in the quench by the point-counting technique of Howard and Cohen. 17 ref. (N8p, 2-60; AY, *H*)

3-N. Martensitic Reaction for Uranium. A. L. Bement and W. P. Wallace. Hanford Atomic Products Operation. *U. S. Atomic Energy Commission,* HW-51084 Rev., June 25, 1957, 26 p.

Isothermal studies on heat treatment and microstructure of uranium. 10 ref. (N6q; U)

4-N. Precipitation Hardening and Embrittlement of High-Strength Titanium Alloys. A. J. Griest, J. R. Doig, P. D. Frost and C. M. Schwartz. Wright Air Development Center Technical Report 54-355, Pt. 3. *U. S. Office of Technical Services,* PB 121890, Nov. 1956, 90 p. (CMA)

Age-hardening behavior of a series of alpha-beta alloys of the systems Ti-Mn, Ti-Mn-Al, Ti-V, Ti-V-Al and Ti-Fe, using hardness, tensile and X-ray diffraction data. Effects of solution temperature, aging temperature and alloy composition on the aging reaction. (N7a, Q26s; Ti)

5-N. (German.) Eutectic Crystallization Structure. E. Scheil and R. Zimmermann. *Zeitschrift für Metallkunde,* v. 48, Sept. 1957, p. 509-516.

Three kinds of eutectic crystallization described. Occurrence of a normal eutectic structure investigated statistically with consideration of the dependence on the volume ratio of the constituents. Degeneration in the system aluminum-Al_2Cu investigated. 14 ref. (N12q; Al)

6-N. (Italian.) X-Ray Diffraction Determination of Recrystallization Curves in Al-Mg Industrial Alloys Containing From 1.5 and 5% Mg. M. Paganelli. *Alluminio,* v. 26, Sept. 1957, p. 353-360.

Temperatures at beginning and end of recrystallization cycle determined for four alloys subjected to varying degrees of cold working, then annealed 1 hr. and given rapid water quench. Given same degree of cold working, initial and final recrystallization temperatures decrease as Mg content increases. 6 ref. (N5, M22g; Al, *Mg*)

7-N. (Russian.) Pearlitic Transformations in Chromium Steels Containing Columbium and Zirconium. D. Ya. Vishnyakov and L. S. Ol'Khova. *Metallovedenie i Obrabotka Metallov,* Sept. 1957, p. 18-21. (CMA)

Observations of isothermal transformations of undercooled austenite. In samples undercooled below the upper bend of the time-temperature curve, pearlite precipitates in needles and not in its usual form. In the part of the diagram corresponding to the upper intermediate stage of the transformation there is a supplementary curve indicating the formation of needle-like pearlite from excess austenite that did not take part in the previous transformation into needle-like troostite. 2 ref. (N8h; AY, *Cr, Cb, Zr*)

8-N. (Czech.) Influence of Silicon and Chromium on the Position and the Range of Eutectoid Temperatures. Stanislav Drapal. *Hutnické Listy,* v. 12, Sept. 1957, p. 769-777.

Studies on spheriodal graphite cast iron show that the formation of austenite starts with preference in middle domains of the dendrites. 10 ref. (N8; Si, Cr) (N8f, 2-60; CI-r, *Si, Cr*)

9-N. (Czech.) Isothermal Austenite Decomposition in Tungsten Alloy Steels. Pt. 3. Josef Cadek and Karel Mazanec. *Hutnické Listy,* v. 12, Sept. 1957, p. 777-788.

Effect of tungsten in steel containing 0.4% carbon; formation of eutectoid containing the carbide M_6C (steels with 4.3 and 9.0% W, respectively) is accompanied by increasing carbon concentration in the untransformed austenite. 24 ref. (N8g; AY, *W*)

10-N. (Czech.) Morphology of Lamellar Pearlite in Steel Containing 2.8% Copper. Ivan Hrivnak. *Hutnické Listy,* v. 12, Sept. 1957, p. 801-803.

Precipitation of a Cu-rich phase in steel containing 0.1% C and 2.8% Cu occurs on the boundaries of ferritic grains as a fine dispersion. 3 ref. (N8h; AY, *Cu*)

11-N. (German.) **Structure of Alloy Electrodeposits. Pt. 12. Copper-Tin Alloys.** E. Raub and F. Sautter. *Metalloberfläche,* v. 11, Aug. 1957, p. 249-252.

High-copper bronze deposits are mostly of the face-centered solid solution type, the solubility limit of which is about 10 times higher than the equilibrium. The speculum deposits consist of the delta and eta-phase of the system copper-tin, and can be transformed into the stable epsilon phase by annealing. 7 ref. (N12d, L17; Cu, Sn)

12-N. (Russian.) **Growth of Large Zinc Crystals With a Predetermined Orientation.** B. N. Bushmanov. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 310-314.

Obtaining large Zn monocrystals. Orientation of crystallographic axis can be predetermined by insertion (in the melt) of a monocrystalline Zn rod, cooled at the opposite end. 12 ref. (N12s, M26; Zn, 14-61)

13-N. (Russian.) **Volumetric Change of Carbide Phase on Tempering of Steel.** N. N. Lyulicheva. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 319-330.

Investigation on steels of a heterogeneous structure, applying methods of space metallography and using optical and electron microscopes. Hypothesis of the carbide phase structure at low tempering temperatures. 14 ref. (N8a, P10d; ST)

14-N. (Russian.) **Texture of Recrystallization of Cold Rolled, Low-Carbon Steel.** K. V. Grigorov and G. P. Blokhin. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 331-338.

Development of recrystallization structure on cold rolling and deformation. Explanation of the relationship by means of model representation of the recrystallization mechanism. 15 ref. (N5, CN)

15-N. (Russian.) **Influence of Intermediate Annealing Upon Texture of Cold Rolling and Recrystallization.** K. V. Grigorov and G. P. Blokhin. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 339-343.

Experimental data on transformer and low-carbon steels applying magnetometric method of measurement. 13 ref. (N5, M26c; CN)

16-N. (Russian.) **Distribution of Carbon on Transformation of Austenite in the Intermediate Zone.** L. I. Kogan and R. I. Entin. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 360-368.

Investigation in respect to composition, temperature and time. 17 ref. (N8; ST)

17-N. (Russian.) **Effect of Deformation Under Low Temperature on Phase Transformations and Properties of 1X18N9T Austenitic Steels.** A. P. Gulyaev and I. V. Chernenko. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 2-7.

Transformation of austenite to martensite in strained samples at temperatures of 100 to −196°. Previously they had been quenched at 1050° in water and stabilized at 800° for 100 hr. (N8p; SS)

18-N. (Russian.) **Strengthening of Austenite by Reverse Martensite Transformation.** V. N. Gridnev, V. T. Cherepin and N. F. Chernenko. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 7-12.

Effect of direct and reverse martensitic transformation on mechanical properties of austenite; effect of speed of heating on kinetics of transformation and stabilization of austenite. The maximum effect of stabilization takes place after the first cycle of heat treatment. 5 ref. (N8p., Q general; ST)

19-N. (Russian.) **Some Rules Governing the Direct and Reverse Martensite Transformation.** E. L. Vinogradskaya and G. A. Kreslina. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 12-15.

The iron-base alloy studied had the following composition: 0.06% C, 13.2% Mn, 0.28% Cu, and 2.12% Co. Transformations were observed by magnetometric methods. Results were related to the change in the quantity of alpha-phase in the samples. (N8p; AY)

20-N. (Russian.) **Cold Hardening, Recrystallization and Softening of Alloyed Austenite.** L. A. Metashop and M. E. Blanter. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 15-23.

The independence of the precipitation processes is shown; dissolving of the carbide and preliminary softening of the cold hardening alloyed austenite by heating. 14 ref. (N8; AY)

21-N. (Russian.) **Effect of Preliminary Hardening on the Rate of Diffusion of Carbon in Austenite.** M. A. Krishtal. *Metallovedeni i Obrabotka Metallov,* no. 8, Aug. 1957, p. 20-21.

The hardening of steel is associated with the formation of microvoids in the formerly solid metallic matrix. These develop in consequence of the tensions associated with the martensite transformation. 5 ref. (N8p, J general; ST)

22-N. (Russian.) **Effect of the Rapidity of Crystallization on the Micro-Heterogeneity of Magnesium Alloys.** Z. A. Sviderskaya, M. E. Drits and E. C. Kadaner. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 23-29.

Many physical and mechanical properties of alloys depend on changes in the structural heterogeneity of the alloy. Heat resistance is one of important factors. Rapid, or very slow cooling, even distribution of structural components ease the process of diffusion, and to a certain degree, lower heat resistance. 12 ref. (N12; Mg)

23-N. (Russian.) **Influence of Additions to Aluminum on the Speed of Reactive Diffusion.** D. I. Lainer and A. Ya. Potemkin. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 33-35.

In the production of Al-clad Ni strip, the products of reactive diffusion exert great influence on the quality of the finished products. (N1, L22; Ni, *Al*)

24-N. (Russian.) **Nature of Martensite Transformation.** M. E. Blanter and P. V. Novichkov. *Metallovedenie i Obrabotka Metallov,* no. 6, June 1957, p. 11-14.

4 ref. (N8p; ST)

25-N.* Microstructure and Mechanical Properties of Ti-Cu-Al and Ti-Cu-Al-Sn Alloys. R. F. Bunshah and H. Margolin. *American Society for Metals, Transactions,* v. 51, Preprint no. 58, 1957, 22 p. (CMA)

TTT-diagrams and the mechanical properties were studied for active eutectoid Ti-base alloys. Ti-8Cu-3Al-2Sn and Ti-5Cu-3Al-2Sn had the best combination of properties when forged in the $\alpha + \beta$ field and annealed in the $\alpha + Ti_2Cu$ field at 750° C. for 24 hr. The reaction $\beta \rightarrow \alpha + Ti_2Cu$ occurs quickly and a stable structure is obtained. Good strength-ductility combinations are also possible with Ti-5Cu-3Al and Ti-8Cu-3Al. Ductility is benefited by the 2% Sn and by primary α, and harmed by ω-phase or long continuous compound paths. 9 ref. (N9, M27, Q23p, Q27a; Ti)

26-N.* Response of an Iron-Base Alloy, Hardened With Titanium, to Various Aging Times and Temperatures. T. W. Eichekberger. *American Society for Metals, Transactions,* v. 51, Preprint no. 60, 1957, 27 p. (CMA)

The effect of adding Ti, Mo, and V on the age hardening of commercial Ni-Cr-Fe alloy was studied in the 1100-1600° F. range for periods extending from 1-512 hr. Neither V nor Ti (below 1.3%) produce much effect. Mo above 2.25% produces hardening above 1400° F. Grain boundaries and twin lines become more definite with increases of aging temperature and time, due to heavy precipitation and within grains of 3.25% Mo specimens become more apparent as the temperature increases beyond 1200° F. Other specimens not containing Mo show a different general precipitation. 4 ref.
(N7a, 2-60; Ni, Cr, Fe, *Ti, Mo, V*)

27-N.* Temperature and Rate Dependence of Strain Hardening in the Aluminum Alloy 2024-0. D. S. Fields, Jr., and W. A. Backofen. *American Society for Metals, Transactions,* v. 51, Preprint no. 61, 1957, 31 p.

Strain hardening characteristics of the Al alloy 2024-0 have been studied over a range of constant shear-strain rates and temperatures. Generally high rates of strain hardening are found at the low temperatures. Little or no strain hardening occurs at the higher temperatures. At intermediate temperatures, the shape of the stress-strain curve is strongly dependent upon strain rate. 17 ref. (N7e, 2-61, 3-67; Al)

28-N.* Magnetic Analysis of Phase Changes Produced in Tempering a High-Carbon Steel. Morris Mentser. *American Society of Metals, Transactions,* v. 51, Preprint no. 66, 1957, 36 p.

Hexagonal close-packed iron carbide was identified magnetically by a direct determination of its characteristic point of inflection at approximately 380° C. Present study showed that hexagonal carbide forms initially upon decomposition of retained austenite in the second stage of tempering, at 230° C. or lower. 28 ref. (N8a, M23a; CN-r)

29-N.* Effect of Silicon, Manganese and Iron on the Aging Characteristics of Aluminium-Copper Alloys Containing 3.0 and 4.5% Copper. A. Chitty. *Institute of Metals, Journal,* v. 86, Oct. 1957, p. 65-76.

Hardness vs. aging-time curves at 21.5, 130 and 190° C. for high-purity Al-base alloys containing 3.0 and 4.5% Cu, with separate additions of up to 2.0% Si and Mn, and up to 2.0% Fe. 23 ref.
(N7a, 2-60; Al, *Cu, Si, Mn, Fe*)

30-N.* Hardness Reversion of Dilute Aluminium-Copper and Alumini-

um-Copper-Magnesium Alloys. R. H. Beton and E. C. Rollason. *Institute of Metals, Journal,* v. 86, Oct. 1957, p. 77-85.

Reversion investigated in naturally aged Al-Cu-Mg alloys with Cu:Mg weight ratios of 7:1 and 2.2:1, and in both naturally and artificially aged Al-Cu alloys. 17 ref. (N7a; Al, *Cu, Mg*)

31-N.* Hardness Reversion of Aluminium-Silver Alloys. R. H. Beton and E. C. Rollason. *Institute of Metals, Journal,* v. 86, Oct. 1957, p. 85-89.

Effect of heating "cold" age hardened Al-Ag alloys examined by means of hardness measurements. Reversion of hardness takes place in two distinct stages at different temperature levels. 16 ref. (N7a; Al, *Ag*)

32-N.* Grain Growth in Metals With Special Reference to High-Purity Nickel. Paul Feltham. *Institute of Metals, Journal,* v. 86, Oct. 1957, p. 95-97.

Grain growth in 99.99% Ni studied in the range 700-900° C. A statistical theory for the most probable initial and instantaneous grain diameters. The validity of the theoretically desired grain growth law is investigated experimentally. 9 ref. (N3; Ni-a)

33-N.* An Investigation Into Some Aging Characteristics of Lead-Antimony Alloys, With Particular Reference to the Effect of Strain. E. J. Hooker. *Institute of Metals, Journal,* v. 86, Oct. 1957, p. 98-107.

Lead alloys containing up to 0.88% antimony were strained by amounts up to 10% after solution treatment, and the progress of aging at room temperature, 100° C. and 150° C. was determined by hardness measurements. Initial and final structures examined metallographically. 29 ref. (N7a, 3-68; Pb, *Sb*)

34-N.* Aging Characteristics of Ternary Aluminium-Zinc-Magnesium Alloys. I. J. Polmear. *Institute of Metals, Journal,* v. 86, Nov. 1957, p. 113-121.

A systematic study of a wide range of ternary Al-Zn-Mg alloys with basic Zn contents of 4, 6, and 8% and Mg contents within the range 0-3%. Hardness vs. aging-time curves were determined at regular intervals between −20 and +240° C., tests being carried out for periods of up to two years. Small quantities of Mg have a pronounced effect on the age-hardening capacity of Al-Zn alloys. 36 ref. (N7a; Al, *Zn, Mg*)

35-N.* Recrystallization Process in Tungsten as Influenced by Impurities. R. A. Swalin and A. H. Geisler. *Institute of Metals, Journal,* v. 86, Nov. 1957, p. 129-134.

Role of special impurity additions in W investigated by electron microscope and neutron diffraction techniques. Certain types of impurity raise the recrystallization temperature of W several hundred degrees and also possibly reduce the nucleation rate of primary grains drastically, thus allowing the entire wire to be occupied by a few large grains. High-temperature annealing results in discontinuous grain growth, with the development of a sharp (320) texture. 8 ref. (N5, 3-69; W)

36-N.* Variations of Transformation Characteristics Within Samples of an Alloy Steel. W. Steven and D. R. Thorneycroft. *Iron and Steel Institute, Journal,* v. 187, Sept. 1957, p. 15-32.

Variations in isothermal transformation characteristics existing within unforged alloy steel ingot samples and in bars and wires produced from the same ingot. Differences between transformation characteristics due to variations in intensity of microsegregation of alloying elements within the samples. 11 ref. (N8g; AY, 5-59, 4-55, 9-69)

37-N.* Diffusion Phenomena in Pressure Welding. A. G. Guy and A. L. Eiss. *Welding Journal,* v. 36, Nov. 1957, p. 473s-480s.

Width, straightness and parallelism of weld interfaces in pressure welded copper-brass specimens studied to determine diffusion processes that occur during subsequent heating and to obtain information on the transport of Zn along the weld interface. 10 ref. (N1h, K5; Cu-n)

38-N. (Czech.) **Thermodynamic Considerations on the Effect of Additions on Cast Iron Graphitization.** Stanislav Drapal. *Hutnické Listy,* v. 12, 1957, p. 683-687.

Effect of addition elements on stability of complex cementite; free combination energy used as stability criterion. Calculated that Cr and Mn would increase stability while Co and Ni would increase instability of complex cementite. 17 ref. (N8s, P12, 2-60; CI)

39-N. (Czech.) **Eutectoid Reaction. Pt. 2. Eutectoid and Pearlite Reaction in Alloy Steels.** Josef Cadek. *Hutnické Listy,* v. 12, 1957, p. 687-695.

Critical analysis of published literature on the mechanism of effects of alloying elements upon eutectoid reaction in steels. Importance of gathering data upon effects of alloying on kinetic parameters, on surface energy, on the boundary of gamma grains as well as energy of phase boundaries, carbide-austenite, ferrite-austenite and carbide-ferrite. 64 ref. (N8h; AY)

40-N. (French.) **Introduction of the Study of Diffusion.** A. D. Le Claire. Paper from "Diffusion in Metals". Bibliotheque Technique Philips, p. 1-17.

Thermodynamic point of view; Fick law and Darken equation, use of chemical potential; crystallographic point of view; influence of composition on the diffusion coefficient; the case of alloys with several components; the mechanism of diffusion of voids; experimental measurement of diffusion coefficients. 21 ref. (N1)

41-N. (French.) **Diffusion of Radiotracers in Solids.** K. Compaan and Y. Haven. Paper from "Diffusion in Metals". Bibliotheque Techniques Philips, p. 19-22.

Method using electric analogy for calculating diffusion coefficients from physical data. The equation giving the relation between diffusion and ionic conductivity is demonstrated. 2 ref. (N1b; 14-63)

42-N. (French.) **Relation Between Diffusion Through Grain Boundaries and Their Structure.** P. Lacombe. Paper from "Diffusion in Metals". Bibliotheque Technique Philips, p. 23-52.

Diffusion as a means of studying the structure of grain boundaries. Experimental methods are emphasized; importance of diffusion through grain boundaries proved directly by autoradiography. 33 ref. (N1, M27f)

43-N. (French.) **Self-Diffusion Through the Grain Boundaries of Alpha Iron.** P. Lacombe and C. Leymoine. Paper from "Diffusion in Metals". Bibliotheque Technique Philips, p. 53-57.

Studied with help of radioactive Fe, to 725° C. Diffusion of radioactive Fe is faster in grain boundaries. Influence of the purity of Fe is low. 12 ref. (N1d; Fe)

44-N. (French.) **Observation on Kirkendall Effect and Electrolytic Transport in Solid Alloys.** Th. Heumann. Paper from "Diffusion in Metals". Bibliotheque Technique Philips, p. 59-77.

Two kinds of Kirkendall effects; the explanation based on the movement of voids. Two examples are studied: an alloy with complete solubility (Au-Ag) and an alloy with intermetallic phases (Cu-Sb). Relation between electrolytic transport and diffusion. 13 ref. (N1e; Au, Ag, Cu, Sb)

45-N. (French.) **Electronic Probing Microanalyzer and Its Use in the Study of the Diffusion in Metals.** J. Philibert. Paper from "Diffusion in Metals". Bibliotheque Technique Philips, p. 77-85.

Microanalyzer observes areas of a radius of 0.001 mm.; diffusion in Fe-Cu alloys and segregation in steels studied. 10 ref. (N1, 1-53; Fe, Cu, ST)

46-N. (French.) **Uranium - Zirconium Diffusion in the Gamma Phase.** Y. Adda and J. Philibert. Paper from "Diffusion in Metals". Bibliotheque Technique Philips, p. 85-91.

Diffusion coefficients are measured on sandwich specimens with the Castain microanalyser. Evidence of the Kirkendall effect in the gamma phase. 10 ref. (N1b; U, Zr)

47-N. (French.) **The Kirkendall Effect and Diffusion in Gold-Platinum Alloys.** A. Bolk and T. J. Tiedema. Paper from "Diffusion in Metals". Bibliotheque Technique Philips, p. 91-97.

Although the Au-Pt diagram includes a region of insolubility, the mechanism of the Kirkendall effect is a usual one. (N1e; Au, Pt)

48-N. (French.) **Diffusion of Interstitial Atoms.** J. L. Meijering. Paper from "Diffusion in Metals". Bibliotheque Technique Philips, p. 97-107.

Activation energies of the diffusion of interstitial atoms and substitutional atoms compared. Diffusion of interstitial atoms is studied with the help of its influence on internal friction. 24 ref. (N1, P13a)

49-N. (French.) **Mass-Spectrometer. Study of the Unsteady Passage of Helium Through Silicon and Germanium.** A. van Wieringen. Paper from "Diffusion in Metals". Bibliotheque Technique Philips, p. 107-113.

Influence of inert gases on the electric properties of semiconductors. Differences in diffusion of He through metals and semiconductors. (N1, P15; Si, Ge, *He*)

50-N. (French.) **Influence of Elastic Deformation on the Movement of Voids in Copper.** C. W. Berghout. Paper from "Diffusion in Metals". Bibliotheque Technique Philips, p. 113-115.

Voids are produced by cold working. Their precipitation is studied by its influence on electrical resistivity. Influence of deformation on the activation energy of diffusion is shown. (N1, Q21; Cu)

51-N. (Japanese.) **Recrystallization of Aluminium Alloys Containing Titanium. Pt. 2.** Satoshi Kugasa. *Japan Institute of Metals, Journal,* v. 21, July 1957, p. 443-446. (CMA)

The preliminary annealing temperature of cold rolled Al-Ti, Al-Ti-Cu and Al-Mg-Ti alloys studied for effect of varying the Ti content; microscopy and hardness testing were used. (N5, T23; Al, Ti, *Cu, Mg*)

52-N. (Japanese.) **Study of Grain Size in Aluminum Sheets.** Takashi Ikeno. *Light Metals,* v. 7, July 1957, p. 28-44.

Effect of annealing conditions and composition on recrystallized grain growth; effects of working strain and gas content on grain growth. 13 ref. (N3, N5; 2-60, 2-64, 4-53; Al)

53-N. (Book-French.) **Diffusion in Metals.** A Symposium. 124 p. 1957. Bibliotheque Technique Philips, Eindhoven, Holland. $5.25.

General introduction; influence of structural defects and grain boundaries on diffusion; theoretical importance of the Kirkendall effect and electrolytic transport; diffusion of atoms and particularly of inert gas; influence of elastic stress on diffusion. Papers abstracted separately. (N1)

Physical Properties

1-P. Irradiation Effects in Uranium and Its Alloys. S. H. Paine and J. H. Kittel. *First Nuclear Engineering and Science Congress,* v. 1, 1957, p. 107-117.

Dimensional changes are a major problem. Various theories advanced of fundamental mechanism; correlation of growth phenomenon with fabrication and structural variables such as composition, rolling temperature, roll pass design, reduction in area, heat treatment, texture and grain size. 7 ref. (P10d, 2-67; U)

2-P. Specific Heats of Liquid Metals and Liquid Salts. T. B. Douglas. *First Nuclear Engineering and Science Congress,* v. 1, 1957, p. 191-199.

General method of measuring and important sources of error; specific heats of mixtures in relationship to those of their components. (P12r; 14-60)

3-P. Influence of Impurities on the Magnetic Properties of High-Purity 3% Silicon Iron. D. A. Leak and G. M. Leak. *Iron and Steel Institute, Journal,* v. 187, Nov. 1957, p. 190-194.

Variation of static hysteresis and coercive force with nitrogen and carbon content for material slowly cooled from a high temperature. 18 ref. (P16, 3-69; Fe, *Si*)

4-P. On the Magnetic Properties of Cubic Cerium. Tsuyoshi Murao and Takeo Matsubara. *Progress of Theoretical Physics,* v. 18, Sept. 1957, p. 215-222. (CMA)

The magnetic susceptibility and specific heat of the cubic form of Ce calculated in terms of the level splitting of the electronic state due to the crystalline and exchange field. The data help explain the anomalous behavior of Ce at low temperatures. 17 ref. (P16, P12r, 2-63; Ce)

5-P. Experimental Determination of the Radiation Decomposition of Boron-10. W. K. McCarty. Atomics International. *U. S. Atomic Energy Commission,* NAA-SR-1999, Oct. 15, 1957, 32 p.

Tests with aluminum capsules containing metal specimens and boron 10-enriched boron trifluoride. (P18h, 1-54; B)

6-P. Dimensional Stability of Uranium-Chromium Alloys. M. C. Fraser, G. A. Last and S. H. Bush. Hanford Atomic Products Operation. *U. S. Atomic Energy Commission,* HW-50624, June 6, 1957, 19 p.

Chromium level, orientation, mechanical, physical properties in relation to irradiation-induced dimensional instability. 4 ref. (P10d, 2-67; U, Cr)

7-P. (German.) **Conductivity and Hall-Constant. Pt. 1. Nickel-Chromium Alloys.** Werner Köster and Peter Rocholl. *Zeitschrift für Metallkunde,* v. 48, Sept. 1957, p. 485-495.

Resistivity, Hall constant, thermoelectric power, magnetic susceptibility, Vickers hardness and Young's modulus of some Ni-Cr alloys between 10 and 37 at. % Cr have been measured. Electron exchange and therefore electrical conductivity are determined by grouping of atoms. 20 ref. (P15g, P15p; Ni, *Cr*)

8-P. (German.) **Electrical Resistivity of Molten Metals. Pt. 3. Electrical Resistivity of Molten Alloys of the Solid Solution Forming Systems Silver-Gold and Copper-Gold and the Eutectic Systems Silver-Copper, Tin-Zinc and Aluminum-Zinc.** Albert Roll and Hasso Motz. *Zeitschrift für Metallkunde,* v. 48, Sept. 1957, p. 495-502.

Resistivity studied as a function of composition and temperature by eddy current method. Resistance anomalies were found in the five systems. No theory has been proposed to explain them. 24 ref. (P15g, 2-60; Ag, Au, Cu, Sn, Zn, Al)

9-P. (German.) **Solutions and Oxides in the System Tantalum-Oxygen.** E. Gebhardt and H. D. Seghezzi. *Zeitschrift für Metallkunde,* v. 48, Sept. 1957, p. 503-508.

Investigation at temperatures between 800 and 1500° C. and at oxygen pressures between 10^{-3} and 2.10^{-2} Torr; kinetics of forming solutions and oxides; maximum solubility of oxygen in the equilibrium state with Ta_2O. 14 ref. (P12; Ta, *O*)

10-P. Electronic Structure of Semi-Conducting Selenium and Tellurium. R. Gaspar. *Acta Physica,* v. 7, no. 3, 1957, p. 289-311.

By taking the lattice structure of the crystal and the electronic structure of the atoms into account the energy band spectrum of semiconducting Se and Te is determined, a main characteristic of which is that the valence and conduction bands are composite. Both the valence and the conduction bands are superpositions of two bands. In one of the overlapping bands the mobility of charge carriers is small while in the other it is great. Some qualitative indication of the relative positions of the overlapping bands is given. Callen's electronic structure scheme is analyzed in detail. 9 ref. (P15, M25, M26; Se, Te)

11-P. Theoretical Interpretation of the Optical and Electrical Properties of Tellurium, Selenium and Their Alloys. R. Gaspar. *Acta Physica,* v. 7, no. 3, 1957, p. 314-324.

Interpretation of the dependence of the infrared absorption spectrum of Te on the polarization of incident radiation, the soft X-ray absorption spectrum of Se and Te, the anisotropy of electrical conductivity and the anomalous variation of the Hall coefficient of Te with temperature. 12 ref. (P15, P17e; Te, Se)

12-P. Heat Capacity of Terbium From 15 to 350° K. L. D. Jennings, R. M. Stanton and F. H. Spedding. *Journal of Chemical Physics,* v. 27, Oct. 1957, p. 909-913. (CMA)

7 ref. (P12r; Tb)

13-P. (German.) **Electrical Properties of Metal Spray Coatings.** K. Sagel. *Metalloberfläche,* v. 11, Aug. 1957, p. 255-257.

Electrical properties in relation to base material, spraying distance, burner adjustment, subsequent mechanical and thermal treatments. Specific resistance of coatings of various thicknesses and compositions. 18 ref. (P15, L23)

14-P. (Polish.) **Testing Electromagnetic Plates.** J. Kurilowicz. *Hutnik,* v. 24, July-Aug. 1957, p. 323-328.

Basic testing of transformer steel plates in d-c. and a-c. magnetic fields. 9 ref. (P16; SGA-r, AY)

15-P. (Polish.) **Magnetic Sound and Its Application in Ferromagnetic Testing.** A. Stryk. *Hutnik,* v. 24, July-Aug. 1957, p. 328-332.

Principle and application of "F" sound in measurement of coercive tension, magnetic anisotropy and discontinuity of materials. 7 ref. (P16, 1-54)

16-P. (Russian.) **Theory of Electron Emission in Ferromagnetic Materials Caused by Electrostatic Field.** A. Z. Veksler. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 222-227.

Computation of electron emission in ferromagnetic materials; relationship between density of the electron stream and spontaneous magnetization of the metal. 5 ref. (P15k; SGA-n)

17-P. (Russian.) **Electric and Magnetic Properties of Intermetallic Compound CdSb.** I. M. Pilat. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 232-238.

Electric and magnetic properties in relation to surplus of cadmium or antimony and admixtures of Al, Te, Pb and Sn. Analysis of the results applying the theory of crystal bonding forces. 11 ref. (P15, P16, 2-60; Cd, Sb)

18-P. (Russian.) **Influence of Elastic Strain and Heat Treatment Upon Magnetic Properties of Certain Tough Magnetic Materials.** M. G. Luzhinskaya and Ya. S. Shur. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 239-244.

Influence of elastic stretching, torsion and heat treatment upon magnetic properties of the alloys: 8% V, 52% Co, 40% Fe; 14% V, 52% Co, 30% Fe; and 15% Mn, 85% Fe. Application of unilateral tensile stresses to the alloys on annealing produces changes in their magnetic properties and structure. 5 ref. (P16, 2-64, 3-68; SGA-n)

19-P. (Russian.) **Certain Magnetic Properties of Dispersion-Hardening Alloys: Iron-Molybdenum and Copper-Nickel-Iron.** V. I. Ivanovskii. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 245-248.

Kinetics of coercive force change of Fe-Mo (18% Mo) alloy at temperature of solid solution decomposition. Coercive force and magnetic density of Fe-Ni-Cu alloy as function of temperature. Kinetics of magnetic density change of Fe-Ni-Cu alloy on dispersion hardening process. 3 ref.
(P16, Fe, Mo, Cu, Ni, SGA-n)

20-P. (Russian.) **Coercive Force of Cold Formed and Annealed Iron Alloys.** G. M. Fedash. *Fizika Metallov i Metallovedenie*, v. 4, no. 2, 1957, p. 257-266.

Relationship between coercive force and concentration of upgrading elements. Influence of cold, plastic deformation and annealing temperature upon coercive force of iron alloys. 7 ref. (P16; Fe)

21-P. (Russian.) **Magnetic Effect of $I_s(t°)$ Curves Obtained From Tempered and Deformed Patterns in Temperature Interval of 260-270° C.** B. A. Apaev. *Fizika Metallov i Metallovedenie*, v. 4, no. 2, 1957, p. 267-277.

Variation of magnetic properties on tempering of hardened steel and on deformation of annealed steel. Discussion of the bend on magnetization curves around 260-270° C. 20 ref. (P16, 2-64; ST)

22-P. (Russian.) **Investigation of Heat Transfer of Self-Aligning Alloys Under Conditions of Stationary Thermal Equilibrium.** G. E. Zolotukhin. *Fizika Metallov i Metallovedenie*, v. 4, no. 2, 1957, p. 352-359.

Experimental determination of heat transfer of Au-Cu and Pt-Cu alloys in respect to annealing time below the critical temperature. 7 ref. (P11k; Au, Pt, Cu)

23-P. (Russian.) **Magnico-Type Alloys With Reduced Cobalt Content.** L. M. Garmash, A. M. Morozova and M. S. Yanskaya. *Metallovedenie i Obrabotka Metallov*, no. 6, June 1957, p. 8-10.

Reducing the Co from 24 to 21% does not require the use of higher magnetic poles in thermomagnetic treatment. (P16; SGA-n, Co)

24-P. Freezing Points of High Purity Metals as Precision Temperature Standards. Pt. 2. Investigation of the Freezing Temperatures of Zinc, Cadmium and Tin. E. H. McLaren. *Canadian Journal of Physics*, v. 35, Sept. 1957, p. 1086-1105.

An investigation with Pt resistance thermometry. Plateaus of essentially constant ($< \pm 0.0001°$ C.) temperature with durations of over 1 hr. are readily obtained on the cooling curves of these metals. For series of freezes on particular samples, the standard deviations of the respective plateau temperatures were of the order of $\pm 0.0002°$ C. Pressure effects on the freezing temperatures were 0.0043° C., 0.0062° C., and 0.0033° C. per atmosphere for Zn, Cd and Sn; respectively. Thermal analysis of these high-purity metals reveals structures and other features associated with nucleation, coring and annealing phenomena; typical thermal curves are shown. 14 ref. (P12n; Zn, Cd, Sn)

25-P.* **Reaction of Hydrogen With Preoxidized Zircaloy—2 at 300 to 400° C.** Earl A. Gulbransen and Kenneth F. Andrew. *Electrochemical Society, Journal*, v. 104, Dec. 1957, p. 709-712.

The permeability of preformed oxide films to hydrogen at 300-400° C. was studied. Two types of reactions were observed. If the oxide film was permeable, a general reaction occurred with the formation of zirconium hydride phases on the surface. If the oxide film was relatively impermeable, reaction occurred at the edges of the sample where defects probably exist in the oxide. 7 ref. (P10m, N15d; Zr, *O*)

26-P. A Metallurgist's View of Metallurgy. Earle E. Schumacher. *Metallurgia*, v. 56, Sept. 1957, p. 129-133.

Research and progress in understanding solid state including plastic flow, atomic scale defects, magnetic properties and low-temperature phenomena.
(P general, N general, Q general)

27-P. Low-Temperature Galvanomagnetic Effects in Bismuth Monocrystals. R. A. Connell and J. A. Marcus. *Physical Review*, v. 107, Second Series, Aug. 15, 1957, p. 940-946.

Measurements of the Hall coefficient and magnetoresistance have been made on Bi monocrystals at liquid He temperatures in range from 3 to 16 kilogauss for all principal crystallographic orientations. Two complete sets of oriented crystals were used, one set grown from unpurified Bi, the other from zone-refined Bi. Pronounced de Haas-van Alphen type oscillations were observed with same periods for both galvanomagnetic effects. For a given orientation of magnetic field with respect to crystal axes, periods were in good agreement with the values found in de Haas-van Alphen effect and were independent of current direction. Impurities were found to have little effect on the period but a large effect on the amplitude of oscillations and on monotonic component of both magnetoresistance and Hall effect. 16 ref. (P16, 2-63; Bi, 14-61)

28-P. De Haas-van Alphen Oscillations in the Thermal and Electrical Magnetoresistance of Tin. Perry B. Alers. *Physical Review*, v. 107, Aug. 15, 1957, p. 959-960.

Oscillatory behavior of the de Haas-van Alphen type has been found in both the electrical and thermal magnetoresistance of an Sn single crystal at liquid He temperatures. Measurements were made in magnetic fields ranging from 22 to 25 kilogauss. Tetragonal axis of the crystal was parallel to the field and perpendicular to rod axis. Thermal and electrical oscillations were in phase and yielded values in substantial agreement with that deduced by Shoenberg from diamagnetic susceptibility requirements. 5 ref. (P16; Sn, 14-61)

29-P. Oscillatory Galvanomagnetic Properties of Bismuth Single Crystals in Longitudinal Magnetic Fields. Julius Babiskin. *Physical Review*, v. 107, Second Series, Aug. 15, 1957, p. 981-992.

Galvanomagnetic effects of oriented single crystals of Bi have been studied in longitudinal magnetic fields up to 60,000 gauss at liquid helium temperatures. Oscillatory behaviors with de Hass-van Alphen periodicity were discovered to be superimposed upon the normal galvanomagnetic effects. 48 ref.
(P16; Bi, 14-61)

30-P. Processes Occurring During the Heat Treatment of Alcomax. A. G. Clegg and M. McCaig. *Physical Society Proceedings*, Section B, v. 70, Sept. 1, 1957, p. 817-822.

The permanent magnet alloy Alcomax has been investigated after different heat treatments using two techniques. Curves of saturation intensity against temperature have been obtained using a Sucksmith balance, and curves of coercivity against temperature by extraction from a solenoid. It is concluded that maxima in the coercivity curves are associated with subsidiary Curie points. Reversible changes in room temperature coercivity produced between 600 and 700° C. are also associated with the appearance and disappearance of subsidiary Curie points. 12 ref. (P16d, 2-64; Al)

31-P. Unusual Magnetic Properties of Quenched Alcomax III. M. McCaig. *Physical Society Proceedings*, Section B, v. 70, Sept. 1, 1957, p. 823-826.

If the permanent magnet alloy Alcomax III is quenched from a high temperature instead of the usual treatment it has the properties of a rather unusual soft magnetic material. The permeability is almost constant up to flux densities over 5000 gauss and the ratio of remanence to saturation intensity is less than 0.1. Details of these properties and their theoretical implications. 3 ref. (P16d, 2-64; Al)

32-P. Temperature Coefficient of Reflectivity of Nickel. L. Ward. *Physical Society Proceedings*, Section B, v. 70, Sept. 1, 1957, p. 862-866.

The variation with temperature of reflecting power of Ni has been measured by null method at five wavelengths in the near infrared region of the spectrum. Results are in satisfactory agreement with those calculated from previous work on emissivity. There was no conclusive evidence for significant change in reflectivity at the Curie point. (P17f; Ni)

33-P. Secondary Electron Emission From Nickel and Molybdenum at Low Primary Electron Energies. A. R. Shulman and E. I. Miaakinin. *Soviet Physics-Technical Physics*, v. 1, no. 10, 1957, p. 2157-2166. (CMA) (Translated by American Institute of Physics.)

3 ref. (P15k; Ni, Mo)

34-P. (Russian.) **Hall Effect in Titanium-Molybdenum Alloys.** N. V. Grum-Brzhimailo and V. G. Gromova. *Zhurnal Neorganicheskoi Khimii*, v. 2, Oct. 1957, p. 2426-2428. (CMA)

3 ref. (P15p; Ti, Mo)

Mechanical Properties and Tests

1-Q. Mechanical Properties of Uranium-Molybdenum Alloys. M. B. Waldron, R. C. Burnett and S. F. Pugh. *First Nuclear Engineering and Science Congress*, v. 1, 1957, p. 151-162. (CMA)

Properties of 14% Mo alloy were determined up to 800° C. for a variety of heat treatments; hardness; Young's modulus; elongation and age hardening in terms of solid solutions in α and γ-U; γ decomposition yielding two-phase structures; de-

composition effect at high temperatures; effect of ordering in the γ-phase. (Q general, 2-67; U, *Mo*)

2-Q. Case Against the Tension Test. John B. Caine. *Foundry*, v. 85, Nov. 1957, p. 86-92.

Examples of catastrophic brittle failures; causes of failure do not include tensile ductility; fatigue strength cannot be evaluated by the tension test; brittle fracture, fatigue fracture, tensile strength are analyzed in relation to steel, nodular, cast and malleable iron. 11 ref. (Q26, Q27, Q7; ST, CI)

3-Q. Mechanical Properties of Zirconium and Zirconium-Uranium Alloys Containing Tin. A. D. Schwope, G. T. Muehlenkamp and W. Chubb. Battelle Memorial Institute. *U. S. Atomic Energy Commission*, BMI-770, Sept. 29, 1952, 18 p. (CMA)

Alloys investigated were Zr-2.5Sn, Zr-3.4U and Zr-U-Sn. Tensile tests show that tin had a strengthening effects. In creep tests Zr-2.5 showed high initial deformations but hardly measurable extension afterward when stresses were high. This did not occur when stresses were low. The hot hardness of the Zr-Sn and Zr-U alloys was about the same.
(Q27a, Q3m, Q29p, 2-60; Zr, *U, Sn*)

4-Q. Mechanical Properties and Microstructure of Annealed Zirconium. W. L. Mudge. Westinghouse Atomic Power Division. *U. S. Atomic Energy Commission*, WAPD-T-46, June 10, 1953, 24 p. (CMA)

Mechanical properties vary with the state of anneal. Hardness was used as an index of annealing conditions. Creep strength and tensile strength are more sensitive to changes of the annealed state than yield strength. 9 ref.
(Q general, 2-64; Zr)

5-Q. Effects of Neutron Bombardment Upon the Properties of Zircaloy-2. M. L. Bleiberg. Westinghouse Atomic Power Division. *U. S. Atomic Energy Commission*, WAPD-MDM-10, May 19, 1954, 15 p. (CMA)

Property changes in Zircaloy-2 wrought by irradiation in high-temperature water. Electrical resistivity increased 15%, hardness increased 33 DPH, and notch toughness decreased at low temperatures and increased at high. Notch toughness was not a function of fast flux.
(Q29n, Q23s, P15g, 2-67; Zr)

6-Q. Titanium. K. E. Mead. *U. S. Atomic Energy Commission*, AECU-3532, May 13, 1957, 25 p. (CMA)

The properties of Ti-8Mn, Ti-5Al-2.5Sn, Ti-4Mn-4Al and Ti-6Al-4V as well as other titanium alloys. Fabrication, soldering, brazing, welding and costs; tensile and creep properties at high temperatures. Safety precautions against titanium fires, dust and explosions. Properties apparently suffer little damage when subjected to a high total dosage of radioactivity. 12 ref.
(Q general, 2-67, A7p; Ti)

7-Q. Ductility in Beryllium Related to Grain Orientation and Grain Size. Jacob Greenspan. Nuclear Metals, Inc. *U. S. Atomic Energy Commission*, NMI-1174, Aug. 9, 1957, 39 p.
18 ref. (Q23p, M27c; Be)

8-Q. Effects of Notch Depth and Low Temperature on the Tensile Properties of Titanium. G. W. Geil and N. L. Carwile. *U. S. National Bureau of Standards*. Summary Technical Report 2163, Oct. 1957, 11 p.

Strength and ductility characteristics of annealed, commercially pure titanium. (Q27a, 2-63; Ti-a)

9-Q. Spot-Welded Joints in Titanium Alloys and Their Behavior in Fatigue. W. H. Kearns, W. S. Hyler and D. C. Martin. Wright Air Development Center, Technical Report 54-609. *U. S. Office of Technical Services*, PB 128518, Mar. 1955, 31 p. (CMA)

Tests on sheets of commercially pure titanium, commercial Ti-7Mn, experimental unalloyed Ti and Type-321 stainless. Joints in stainless were slightly better than in Ti, while the latter were significantly better than in clad 24S-T and 75S-T Al. (Q7a; Ti, SS, Al, 7-51)

10-Q. Effect of Hydrogen on the Mechanical Properties of Titanium and Titanium Alloys. G. A. Lenning, L. W. Berger and R. I. Jaffee. U. S. Watertown Arsenal Laboratory, Report 401/79-32. *U. S. Office of Technical Services*, PB 125201, July 1955, 57 p. (CMA)

Notched and unnotched fatigue tests on commercial A-55 and Ti-8Mn indicate that as much as 400 ppm. hydrogen does not significantly alter the fatigue properties. Effect of beta-stabilizing additions on the hydrogen tolerance of alpha titanium alloys; 2% Mo showed the greatest benefit. Hydrogen tolerance for high notch-bend impact properties was increased from about 100 to at least 200 ppm.
(Q7a, Q6n, 2-60; Ti, *H*)

11-Q. Flow Properties, Deformation Textures and Slip Systems of Titanium and Titanium Alloys. F. C. Holden, D. N. Williams, W. E. Riley and R. I. Jaffee. Battelle Memorial Institute, Titanium Metallurgical Laboratory, Report 30. *U. S. Office of Technical Services*, PB 121608, Jan. 1956, 102 p. (CMA)

Methods used to predict formability; flow properties of a number of experimental titanium alloys. The effects of strain transformation, temperature and hydrogen on flow properties. Deformation mechanisms of alpha-titanium at several temperatures, and types of deformation textures. (Q23q, Q24, M26c; Ti)

12-Q. Effect of Impact on Beams and Welded Structural Connections. Paul J. Brennan and Harry A. B. Wiseman. *Welding Journal*, v. 36, Oct. 1957, p. 465s-472s.

Under static and dynamic loading conditions. Timestrain curves are given. (Q6; 7-51)

13-Q. Stress Relieving of Weldments. Earl R. Parker. *Welding Journal*, v. 36, Oct. 1957, p. 433s-441s.

Origin, nature and effect of residual stresses and influences of thermal and mechanical stress-relieving treatments on service performance of welded structures. 23 ref.
(Q25h, J1a, G23; 7-51)

14-Q. (Russian.) **Influence of Titanium and Nitrogen on the Structure and Properties of Welded High-Chromium Thin Sheet Steel.** D. A. Odesskii and V. M. Vozdvizhenskii. *Metallovedenie i Obrabotka Metallov*, no. 9, Sept. 1957, p. 42-46. (CMA)

In the zone adjoining the weld titanium steel presents large grains of ferrite that increase the brittleness of the material, whereas nitrogen steel (especially that containing 2% Ni) is free from this defect, the growth of ferrite grains being prevented by the formation of a continuous film of austenite around the grains. 8 ref.
(Q26s, 2-60, N3; AY, *Cr, Ti, N*, 7-1)

15-Q. (Russian.) **Cold Rolling of Sheet Steel Containing Vanadium or Aluminum for Deep Drawing of Automobile Body Parts.** D. A. Litvinenko, A. A. Rastorguev and V. K. Barzii. *Stal'*, v. 17, May 1957, p. 445-449.

Low-carbon rimmed steels with addition of 0.03 to 0.04% V, or killed steels with 0.007% Al, have desirable properties for deep drawing and stamping. They show no draw lines after passing through the die. 4 ref. (Q23q, G4b; AY, 4-53)

16-Q. (Russian.) **Ductility of Cold Rolled Transformer Steel.** A. G. Petrenko, A. V. Smirnova and L. A. Kurtova. *Stal'*, v. 17, May 1957, p. 453-456.

Lack of ductility in cold rolled transformer steel is generally caused by carbide phase particles precipitating around grain boundaries. Repeated annealing at 750 to 850° C. reduces quantity of the carbide phase and increases ductility. 4 ref. (Q23p, N7; AY, SGA-r)

17-Q. Effect of Fretting on Fatigue Characteristics of Titanium-Steel and Steel-Steel Joints. W. L. Starkey, S. M. Marco and J. A. Collins. *American Society of Mechanical Engineers. Preprint 57-A-113*, Aug. 8, 1957, 10 p. 23 ref. (CMA)
(Q7, Q9q; Ti, ST)

18-Q. Instrument for Making Micro-Hardness Measurements at Elevated Temperatures. *Industrial Diamond Review*, v. 17, Sept. 1957, p. 177-178.

Developed by Camstock and Wescott Inc. for Watertown Arsenal. (Q29q, 2-62, 2-53)

19-Q. Micro-Hardness Testing: Experience With the G. K. N. and Other Machines. R. Wall. *Iron and Steel*, v. 30, Nov. 1957, p. 611-612.
(Q29q, 1-53)

20-Q. Frictional Heating and Its Influence on the Wear of Steel. N. C. Welsh. *Journal of Applied Physics*, v. 28, Sept. 1957, p. 960-968.

High frictional temperatures during dry or imperfectly lubricated rubbing of steel produce gross structural changes and intense hardening of surface layers. Protective layer establishes itself more readily as carbon content of steel increases, a feature explained by ease with which eutectoid pearlite transforms to austenite, and thence to martensite, during rapid temperature cycle. By stimulating hot spots during wear by thermal action of electric sparks, hardness change is shown to be intensified by nitrogen or carbon adsorbed from atmosphere or lubricant. 24 ref. (Q9p; ST)

21-Q. Plastic Deformation of Copper and Silver Whiskers. S. S. Brenner. *Journal of Applied Physics*, v. 28, Sept. 1957, p. 1023-1026.

Studied by rapidly reducing stress after yielding. Whiskers exhibit extremely sharp yield points and extensive easy "glide" regions due to propagation of Luder's bands. It is unlikely that sharp yield points are caused by dislocation pinning. Propagation of Luder's bands often becomes obstructed, giving rise to repeated yielding in plastic region. Nature of these obstructions and

mechanism of Luder's band propagation are not clear. 8 ref. (Q24; Au, Ag, 14-61)

22-Q. Columbium, Tantalum, Tungsten and Molybdenum. *Materials in Design Engineering,* v. 46, Sept. 1957, p. 85. (CMA)

Tabulated data on physical, mechanical, fabricating and corrosion resistant properties. Applications given. (Q general, P general, R general; Cb, Ta, W, Mo, 17-57)

23-Q. Equipment and Procedures for Rapid Heating and Testing. *Metal Progress,* v. 72, Nov. 1957, p. 97-100.

Advanced electronic equipment is needed to measure and record accurately the temperature and deformation in tests completed in seconds. Rapid heating is done by electrical resistance or in hot fluid. Results vary widely unless test conditions and metallic state are rigidly controlled. (Q general, 1-53, 2-62)

24-Q. Observation on the Distribution of Slip in Polycrystalline Copper. D. S. Kemsley. *Philosophical Magazine,* v. 2, 8th Series, Sept. 1957, p. 1103-1104.

Concentration of slip into bands increases with increasing prior tensile and fatigue deformation. 7 ref. (Q24a; Cu)

25-Q. Velocity of Sound in Metals at High Temperatures. J. F. W. Bell. *Philosophical Magazine,* v. 2, 8th Series, Sept. 1957, p. 1113-1120.

A pulse method of measuring the velocity of sound in thin rods over a wide temperature range, in some cases to the melting point, has been developed. Measurements on Al, brass, Ni, Fe, Pb, solder and Tl show that, in the strain-free condition, the method is a sensitive indication of physical and structural changes. The changes associated with the onset of a liquid phase, the Curie point, order-disorder and other structural changes described. 3 ref. (Q21f, 2-62)

26-Q. (German.) **Relation Between Rockwell C Hardness and Rockwell Hardness at 62.5 KP.** S. Sohrmann. *Fertigungstechnik,* v. 7, July 1957, p. 334-335.

For hardness tests on thin layers (carburized rims or sheets), the depth of penetration using the standard Rockwell-C test is too great. By reducing the test load from 150 kp. to 62.5 kp. satisfactory conditions were obtained. A conversion formula was developed. (Q29e)

27-Q. (German.) **Influence of Additives Upon the Behavior of Brass Under Load and at Elevated Temperatures.** J. Herenguel and M. LeNouaille. *Metall,* v. 11, Aug. 1957, p. 652-655.

Low-phosphorus and Mg additions and to a smaller degree, Cr, add to the strength of brass under heat. These additions help to prevent intercrystalline embrittlement, especially in hot forming. Bi, As and Sb have adverse effects as additives. 5 ref. (Q27, Q26s, 2-60; Cu-n)

28-Q. (German.) **Creep Properties of Soft Solders.** E. Dürrwächter. *Metall,* v. 11, Sept. 1957, p. 740-742.

Several soft solders were subjected to hardness tests, under load for periods up to 30 min. Hardness decreased with increasing time. Additions of Ag and Sb improved the creep properties of pure Sn solders, as did Ag with Cd-Sn solders. Ag does not have any influence on Pb-Sn solders. 6 ref. (Q3, Q29, 2-60; Sn, Cd, Pb, *Ag, Sb,* SGA-f)

29-Q. (German.) **Electrons in the Wear Process.** H. Rörig. *Metall, v.* 11, Sept. 1957, p. 768-769.

Under severe wear conditions surfaces undergo a process of chemical activation, resulting from an emission of electrons. (Q9)

30-Q. (German.) **Mechanical Properties of Hard-Drawn Spring Wire.** Franz Bleilöb and Emil Schücker. *Stahl und Eisen,* v. 77, Oct. 3, 1957, p. 1362-1368.

Minimum values obtainable for reduction of area, shear value at rupture and number of torsions are dependent on wire diameter for classes of mechanical strength provided for. Comparison between configuration of the rupture in torsion and the number of torsion cycles. Coiling and bend test. (Q general; ST, 4-61)

31-Q. (Italian.) **Behavior of Alloy Steels at Subzero Temperatures.** *Nickel,* no. 67, Apr. 1957, p. 1-15.

Effects of subzero temperatures on mechanical properties of steels and influence of some alloying elements, particularly Ni, of hardening and tempering, and of welding. Tabulation of properties at below zero of four En-series steels (23, 24, 25 and 30B) similar in composition to Italian standards.
(Q general, 2-63, 2-64; AY, SS)

32-Q. (Russian.) **Mechanism of Plastic Deformation and Mechanical Properties of Aluminum.** E. S. Yakovleva. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 306-309.

Mechanical properties of Al wire stretcher at rate of 7.3×10^4, 73 and 2.3% and at temperatures of −196, 18 and 250° C., respectively. 9 ref. (Q general; Al, 4-61)

33-Q. (Russian.) **Properties and Structure Changes in Solid Solutions Containing Nickel.** Sh. Sh. Ibragimov and B. G. Livshits. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 315-318.

Changes of microstructure and properties of solid solutions of Ni-Cr and Ni-Cr-Fe due to hot and cold working. Anomalous character of the changes can be explained by diffusion of atoms within the lattice of the solid solution. Kinetics and activation energy of the process. 4 ref. (Q general, M27, 3-68, Ni, SS)

34-Q. (Russian.) **Internal Friction of Pure Metals in Respect to Temperature.** V. S. Postnikov. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 344-351.

Determination of internal friction of Al, Cu, Ni, Fe, Co, Ti, Mo, W, Sn, Pb, Mg, Ag, Au, and Pt, applying method of twisting swings of small amplitude. 13 ref. (Q22, 2-61)

35-Q. (Russian.) **Residual Stresses in Surface Hardened Products After Annealing at the Breakdown Temperature of Martensite.** N. M. Korbin and K. V. Shishokina. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 29-33.

A change in sign (from negative to positive) of the residual stresses takes place in the hardened layer when annealed at the breakdown temperature of martensite. 8 ref. (Q25h, N8p, J23; ST)

36-Q. (Russian.) **Effect of Additions on the Plasticity of Brass No. L62.** A. A. Presnyakov. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 53-55.

Alloy additions and varying temperatures change the plasticity of brass and influence its resistance to tear and deformation. 8 ref. (Q24, 2-60; Cu-n)

37-Q. (Russian.) **Study of Zones of Failure in Creep.** I. L. Mirkin and I. I. Trunin. *Metallovedenie i Obrabotka Metallov,* no. 6, June 1957, p. 2-7. (Also available as Henry Brutcher Translation No. 3979.)

Microhardness was reduced near the fissure developed by creeping. This may be explained by fine cracks in the material which have grown out of an accumulation of voids in the crystal lattice along the line of failure. 11 ref. (Q3, M26)

38-Q. (Russian.) **Softening of Metals Subjected to Plastic Deformation.** V. N. Danilov. *Metallovedenie i Obrabotka Metallov,* no. 6, June 1957, p. 15-16.

The effect of deformation was measured by application of a thermo-electromotive force whose coefficient bears a direct relationship to metal strength, and by measuring microhardness. 9 ref. (Q24, P15, Q29q)

39-Q. (Russian.) **Correlation Between Endurance and Prolonged Stress of Alloys at Elevated Temperatures.** V. A. Parfenov. *Metallovedenie i Obrabotka Metallov,* no. 6, June 1957, p. 17-23.

Curves of endurance and prolonged stress cross each other when plotted on stress-versus-time to failure coordinates. 10 ref. (Q7a, Q25, 2-62)

40-Q. (Russian.) **Summary of Discussion on Temper Brittleness.** V. D. Sadovsky. *Metallovedenie i Obrabotka Metallov,* no. 6, June 1957, p. 24-42. (Also available as Henry Brutcher Translation No. 3980 and 4043.)

Temper brittleness appears to be the effect of segregation of the phases in the solid state at the grain boundaries and also within the grains, or mosaic-like blocks resulting from prolonged cooling, or sudden cooling from high temperatures. 58 ref. (Q26s; ST)

41-Q. (Russian.) **Effect of Hydrogen on the Brittleness of Titanium Welded Joints.** S. M. Gurevich. *Metallovedenie i Obrabotka Metallov,* no. 6, June 1957, p. 47-50.

Within the range of 0.01 to 0.5% hydrogen content brittleness increases with a corresponding decrease in plasticity. 11 ref. (Q26s, 2-60; Ti, *H,* 7-51)

42-Q. (Russian.) **Effect of Surface Conditions of Steel 30KhGSA on Tendency Toward Fatigue.** T. K. Zilova, V. E. Sadovskii and N. I. Demina. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1957, p. 2-7.

Sensitivity of this steel toward fatigue increases when its surface is hardened either by heat or mechanical treatment. 4 ref. (Q7a; AY)

43-Q. (Russian.) **Influence of Cross Section on the Properties of Alloy No. ML5.** N. M. Techova and V. A. Blochina. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1957, p. 16-19.

In samples with annular cross section the rate of decreasing strength at high temperatures is markedly lower than that of smooth samples. (Q27, 2-62)

44-Q. (Russian.) **Properties of Sh X 15 Steels at Low Temperatures.** A. N. Istomina. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1957, p. 24-27.

Mechanical properties were not greatly affected to −60° C., but at −180° C. their relative compressive strength was considerably lowered. 5 ref. (Q general, 2-63; AY)

45-Q. (Russian.) **Effect of Trimmed Edges on the Properties of Cold**

Rolled Strip. P. S. Sacharov. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1957, p. 43-46.

Trimming causes cold brittleness along the edges of the strip. Removing burr only on one side has little effect, but rounding the edges restores some of the original plasticity. Best results are obtained through heat treatment.
(Q26s, F29q; 4-53)

46-Q.* Cleavage Step Formation in Brittle Fracture Propagation. J. M. Berry. *American Society for Metals, Transactions,* v. 51, Preprint no. 57, 1957, 44 p.

Some of the metallographic features of brittle fracture propagated at high velocities in single crystals of Si-Fe and a discussion of the three-dimensional geometry of the varied markings observed on the fracture surfaces. 10 ref.
(Q26s, Q26n, M27; Fe, *Si,* 14-61)

47-Q.* Unique Deformation and Aging Characteristics of Certain Magnesium-Base Alloys. S. L. Couling, J. F. Pashak and L. Sturkey. *American Society for Metals, Transactions,* v. 51, Preprint no. 59, 1957, 20 p.

Certain Mg alloys exhibit unlimited cold rollability. A plot of per cent rolling reduction versus tensile yield strength for these alloys shows the yield strength to reach a maximum at about 15% reduction, and to decrease progressively from this point on with increasing reductions. Aging the cold rolled material at a low temperature raises the yield strength; the greater the rolling reduction, the higher the yield strength on subsequent aging. The deformation mechanism operative in these alloys which accounts for their unusual property variations is described and the probable aging mechanism discussed. 10 ref.
(Q24, N7, F23; Mg)

48-Q.* Effect of Grain Size and Carbon Content on the Yield Delay-Time of Mild Steel. J. M. Krafft and A. M. Sullivan. *American Society for Metals, Transactions,* v. 51, Preprint no. 65, 1957, 31 p.

The delay time for onset of gross yielding after sudden application of constant stress has been measured for mild steels of varied carbon content and grain size. The delayed yield is thought to provide a measure of the upper yield point sufficiently exact to permit a separation of the effects of some of the principal metallurgical parameters upon it. 17 ref. (Q21, 2-60, 3-71; CN)

49-Q.* Temperature and Stress Dependence of the Atmophere Effect on Nichrome V. Paul Shahinian and M. R. Achter. *American Society for Metals, Transactions,* v. 51, Preprint no. 69, 1957.

Creep-rupture tests have been performed in vacuum and air on Nichrome V at a range of temperatures and stresses. While the alloy tends to be stronger in air than vacuum at high temperatures and low strain rates, the reverse is true at low temperatures and high strain rates. 4 ref. (Q3m, 2-61, 3-66; Ni)

50-Q. Compilation of Chemical Compositions and Rupture Strengths of Super-Strength Alloys. *ASTM Special Technical Publication* No. 170-A, 6 p.

Name, nominal chemical composition, characteristic rupture strengths for rupture in 100 and 1000 hr., and patentee for approximately 150 domestic and 75 foreign alloys. Includes ferritic (martensitic) alloys and age-hardening stainless steels. Conventional austenitic stainless steels are not included. (Q3m; SS)

51-Q.* Practical Wear Testing of Cast Iron. R. B. Whitelaw. *Australian Institute of Metals, Journal,* v. 2, Aug. 1957, p. 54-65.

Reviews theories of wear with reference to cast iron, wear testing in the field and by means of laboratory testing machines. Use of Repco wear testing machine and comparison of microstructure, hardness and wear index of various types of cast iron. 12 ref. (Q9, 1-54; CI)

52-Q.* Effect of Prior Strain on the Creep of High-Purity Lead. R. C. Gifkins. *Australian Institute of Metals, Journal,* v. 2, Aug. 1957, p. 66-71.

Effect of small amounts of prior stain on creep at stresses of 400 psi. on vacuum cast and extruded high-purity lead. 19 ref. (Q3, 3-68; Pb-a)

53-Q.* Theories of Metallic Creep. J. M. Summerton. *Birmingham Metallurgical Society, Journal,* v. 37, Sept. 1957, p. 537-552.

Characteristic creep curves, time laws and theories of creep. Note on structural changes during creep. 37 ref. (Q3)

54-Q.* Properties Revealed by Tensile Tests on Pearlitic Nodular Irons. G. N. J. Gilbert and K. B. Palmer. *British Foundryman,* v. 50, Sept. 1957, p. 441-457.

Tensile properties at low, room and elevated temperatures in air, water, mercury and aliphatic hydrocarbons with variations in As, Sn, Si and P content and following normalizing. Variation in ductile to brittle transition and relationship of transition temperature to change in tensile strength and elongation with composition, normalizing and testing medium. Embrittlement at high temperatures. 4 ref.
(Q27, Q23r; CI-r)

55-Q.* Influence of Heat Treatment Upon the Impact Properties of Spheroidal Graphite Cast Iron. J. H. Gittus. *British Foundryman,* v. 50, Sept. 1957, p. 466-474.

Specimens of spheroidal graphite cast iron after heat treatment to insure fully ferritic structure were subjected to a series of heat treatments and then tempered at 300, 350, 400 or 450° for 15 min., 30 min., 1 hr., 3 hr. or 24 hr. Impact values and fracture examination demonstrated influence of grain size and tempering treatments on the transition impact characteristics. 17 ref.
(Q6n, 2-64; CI-r)

56-Q.* A Comparison of Methods of Assessing Spot-Weld Ductility in Sheet Steels. Pt. I. Experimental Investigation. E. J. French and A. A. Wells. *British Welding Journal,* v. 4, Nov. 1957, p. 514-529.

Theoretical strengths derived from a consideration of idealized welds are compared with experimental results, the cruciform tension test showing a high degree of ductility discrimination lacking in the shear and torsion tests. The ratio of experimental to theoretical tension strength and the tension ratio is considered as a measure of spot-weld ductility together with other suitable tests. 17 ref.
(Q23p, Q27, 1-54; ST, 7-51)

57-Q.* Effect of Neutron Irradiation on the Mechanical Properties of Molybdenum and Tungsten. M. J. Makin and E. Gillies. *Institute of Metals, Journal,* v. 86, Oct. 1957, p. 108-112.

Changes in mechanical properties of stress-relieved Mo and fully recrystallized W after irradiation at 100° C. with 5×10^{19} neutrons per sq. cm. studied at a variety of temperatures; influence of irradiation on the ductile to brittle transition temperature. 14 ref.
(Q general, Q23r, 2-64; Mo, W)

58-Q.* A Compressive Creep Test of Alpha-Uranium Under Neutron Irradiation. H. C. Rose. *Institute of Metals, Journal,* v. 86, Nov. 1957, p. 122-128.

Apparatus designed for measuring compressive creep of U during irradiation in a Windscale pile—in particular, the behavior of alpha-U at 450° C. under a stress of 2.7 tons per sq. in. Irradiation does not appreciably affect the secondary creep rate at this temperature. A transient increase in creep rate, which may be due to thermal cycling, was observed on pile start-up after cooling down between creep runs. 11 ref. (Q3, 2-67; U)

59-Q. A New Way to Select Wear-Resistant Materials. J. R. Driear. *Iron Age,* v. 180, Nov. 21, 1957, p. 121-124.

Wear applications and suggested materials classified according to stress and self-lubrication properties.
(Q9n, 17-57; SGA-m)

60-Q. Copper-Base Alloy Compares With Nickel Silver. C. H. Hannon. *Iron Age,* v. 180, no. 21, Nov. 21, 1957, p. 134-136.

(Q general; Cu, *Zn, Al, Ni, Ag*)

61-Q. Analysis of Stresses and Strains Near the End of a Crack Traversing a Plate. G. R. Irwin. *Journal of Applied Mechanics,* v. 24, Sept. 1957, p. 361-364.

Mathematical analysis, stress field near end of somewhat brittle tensile fracture in situations of generalized plane-stress or plane-strain approximated by the two parameter sets of equations—one, an adjustable stress parallel to the direction of crack extension and the other, the stress intensity factor, is proportional to the square root of the force tending to cause crack extension. 10 ref.
(Q25n, Q26q)

62-Q.* Specific Damping Energy of Fixed-Fixed Beam Specimens. W. C. Hagel and J. W. Clark. *Journal of Applied Mechanics,* v. 24, Sept. 1957, p. 426-430.

Internal damping effects of varying composition, heat treatment, cold work, magnetic field strength, stress history and static tension studied at room temperature on AISI 403 steel by fixed-fixed beam specimens supported in new bending vibration-decay apparatus. Experimental logarithmic decrements converted to specific damping energies by straightforward numerical method. 9 ref. (Q22; SS)

63-Q. Three Manganese Alloys Have Useful Thermal and Elastic Properties. John L. Everhart. *Materials in Design Engineering,* v. 46, Nov. 1957, p. 144-146.

Mn-Cu alloys, Mn-Ni-Cu alloys and ternary alloys containing Mn, Fe and 5% of Al, Co, and Ni.
(Q general, P general; Mn, *Cu, Ni, Fe, Al, Co*)

64-Q.* Flow and Fracture. Earl R. Parker. *Metal Progress,* v. 72, Nov. 1957, p. 65-69.

Today, designers and constructors of advanced machines and structures are often hampered by inadequate materials, a dilemma which can be solved only after acquiring knowledge about crystalline structure at an atomic level. Progress in this line has been sufficient to devise substantial improvements in creep resistance. A ductile ceramic also seems a fairly early possibility. (Q24, Q26, N general)

65-Q.* Physical Properties of Electrodeposited Metals. Pt. 2. T. E. Such. *Metallurgia*, v. 56, Sept. 1957, p. 121-124.

Determination of tensile strength, ductility, hardness and internal stress in electrodeposited metals. 6 ref. (Q general; 8-62)

66-Q. Mechanics of Formation and Machine Shaping of Materials. *Metallurgia*, v. 56, Sept. 1957, p. 134-136.

Plastic flow under combined stresses, behavior of materials under high hydrostatic pressure and effect upon plastic properties of strain rate and temperature. Relation to behavior of metals in extrusion, forging, or rolling. 6 ref. (Q23q, Q24, F general)

67-Q.* Hardness and Other Physical Properties of Metals in Relation to Temperature. E. R. Petty. *Metallurgia*, v. 56, Nov. 1957, p. 231-236.

Mode of deformation in the "equicohesive range" used to explain the form of the hardness-temperature relationship for pure metals. A simple correlation between hardness and creep properties is shown for a variety of metals. 38 ref. (Q29, 2-61, Q3m)

68-Q.* Properties of Materials at High Rates of Strain. K. N. Leibovic. *Metallurgia*, v. 56, Nov. 1957, p. 239-241.

Propagation of stress waves; elastic and plastic strains; effect of high strain rate on yield and fracture; fundamental theory and experiments. 7 ref. (Q25n)

69-Q. Elastic Constants of Magnesium From 4.2° K. to 300° K. L. J. Slutsky and C. W. Garland. *Physical Review*, v. 107, Second Series, Aug. 15, 1957, p. 972-976.

Adiabatic elastic constants of Mg single crystals have been measured by an ultrasonic pulse technique. Values extrapolated have been calculated as well as Debye characteristic temperature at 0° K. Atomic force constants for a central-force model with an electron gas term were also obtained. 17 ref. (Q21, 2-63; Mg)

70-Q.* Parts Made of Selected High Strength Cast Steels. Robert J. Ely. *Precision Metal Molding*, v. 15, Nov. 1957, p. 39-40, 96-97, 108-109.

Deoxidation practice, melting methods, chemistry and heat treatment of low-alloy martensitic steels. Effect of C, Si and dehomogenization; reproducibility of properties at 180,000 psi. and above. (Q general, 3-70; AY, SGB-a)

71-Q. Bursting Tests of Zircaloy-2 Tubing. Pt. 1. Preliminary Investigation Using Tubes Machined From Bar Stock. B. R. Price and L. F. Cochrun. Westinghouse Atomic Power Division. *U. S. Atomic Energy Commission*, WAPD-FE-749, (no date), 38 p. (CMA)

(Q10b; Zr)

72-Q. Creep Strength of Uranium Alloys at 1500 and 1800° F. H. A. Saller, et al. Battelle Memorial Institute. *U. S. Atomic Energy Commission*, BMI-834, May 28, 1953, 30 p. (CMA)

(Q3m; U, *Mo, Zr, Ti*)

73-Q. Effect of Wall Thickness Tolerance on Some Properties and Failure Characteristics of Reference Size Zircaloy-2 Tubing. L. F. Cochrun. Westinghouse Atomic Power Division. *U. S. Atomic Energy Commission*, WAPD-FE-1004, Sept. 19, 1955, 9 p. (CMA)

(Q10b; Zr)

74-Q. Laboratory Bend Testing of Zircaloy-2. W. L. Frankhouser. Westinghouse Atomic Power Division. *U. S. Atomic Energy Commission*, WAPD-FE-1082, Oct. 18, 1955, 31 p. (CMA)

(Q5; Zr)

75-Q. Hydrogen Migration in Zircaloy-2. B. Lustman. Westinghouse Atomic Power Division. *U. S. Atomic Energy Commission*, WAPD-PWR-PMM-1053, Mar. 12, 1957, 14 p. (CMA)

(Q26s; Zr)

76-Q. Neutron Irradiation Effects on the Tensile Properties of Zircaloy-2. R. S. Kemper and D. L. Zimmerman. Hanford Works. *U. S. Atomic Energy Commission*, HW-52323, Aug. 22, 1957, 24 p. (CMA)

12 ref. (Q27a, 2-67; Zr)

77-Q.* Crack Initiation and Propagation in the V-Notch Charpy Impact Specimen. Carl E. Hartbower. *Welding Journal*, v. 36, Nov. 1957, p. 494s-502s.

Easily executed variation in the standard technique permits separation of crack-initiation and crack-propagation stages of the fracture process. The differentiation between ductile and brittle fracture is based on the concept that a brittle-fracture crack is propagated by continuous release of the elastic stress field, whereas a ductile-fracture crack requires plastic deformation to extend the crack. 9 ref. (Q26, Q6; ST, 7-51)

78-Q.* Relation of Charpy Impact Properties to Microstructure of Three Ship Steels. W. S. Owen, D. H. Whitmore, Morris Cohen and B. L. Averbach. *Welding Journal*, v. 36, Nov. 1957, p. 503s-511s.

Extent to which fracture properties can be accounted for in terms of gross microstructural parameters. The ferrite-pearlite aggregate was varied systematically by means of annealing and normalizing treatments, and correlations were obtained between several measured microstructural parameters and the Charpy V-notch transition temperature. 22 ref. (Q6, Q26, M27; ST)

79-Q.* X-Ray Diffraction for Residual Stress Measurements of Restrained Weldments. E. H. Kinelski and J. A. Berger. *Welding Journal*, v. 36, Dec. 1957, p. 513s-517s.

Theoretical and experimental studies indicate X-ray diffraction by the two-exposure method to be an excellent tool for the measurement of residual stresses in Monel plate weldments. (Q25h, M22g; Ni, 7-51)

80-Q.* Effect of Specimen Geometry on Charpy Low-Blow Transition Temperature. G. M. Orner and C. E. Hartbower. *Welding Journal*, v. 36, Dec. 1957, p. 521s-527s.

Variation in the standard technique for testing Charpy impact specimens permits a separation of the crack-initiation and crack-propagation stages of the fracture process. The technique requires initiation of a crack by means of a low-energy blow and propagation of the crack by a full-capacity blow of the impact-machine pendulum. Tests show the low-blow transition temperature to be independent of notch and specimen geometry within the limits of notch acuity and specimen size investigated. 9 ref. (Q6, Q26, 1-54)

81-Q.* Studies of the Weld Heat-Affected Zone of T-1 Steel. E. F. Nippes, W. F. Savage and R. J. Allio. *Welding Journal*, v. 36, Dec. 1957, p. 531s-540s.

Slow cooling rates after welding such as may result from either high energy input or high initial plate temperature have a damaging effect upon the notch toughness in the heat affected zone of T-1 steel. 16 ref. (Q23s; ST, 7-51)

82 Q. Micro Hardness Testing. R. Wall. *Wire Industry*, v. 24, Oct. 1957, p. 961.

Procedure and methods of testing wire specimens. Precautions for avoiding errors. (Q29q; 4-11)

83-Q. (Czech.) **Effect of Boron Addition on Properties of Structural Steels.** Vladimir Keclik. *Hutnické Listy*, v. 12, 1957, p. 696-703.

Results of boron addition to normally killed steel and steel killed by large amounts of Al, Ti or Zr. Boron improves some properties of steel, most notably through hardening. Production difficulties. (Q general; ST, *B*, AD-q40)

84-Q. (Czech.) **Influence of Residual Austenite in Carburized Layers on Behavior Under Alternating Stresses.** Bohumil Prenosil. *Hutnické Listy*, v. 12, 1957, p. 704-711.

Influence of residual austenite in carburized layers of alloy steels on the endurance limit under alternating stressing; compares endurance limits of specimens in which residual austenite is removed by low-temperature treatment with untreated specimens. 45 ref. (Q7a, N8; ST)

85-Q.* (French.) **Observation of Streaked Stress-Strain Curves in the Case of a Beta'-Matrix Brass.** Henri de Leiris. *Comptes Rendus*, v. 245, Sept. 9, 1957, p. 966-968.

Fluctuations in stress-strain curves may be due to modification of solubility of a second dispersed phase in the beta matrix. 4 ref. (Q25n; Cu-n)

86-Q. (French.) **Influence of Silicon and Phosphorus on the Temper Brittleness of Malleable Irons.** Paul Bastien, Pierre Azon and Christiane Winter. *Fonderie*, no. 139, Aug. 1957, p. 343-352.

Malleable irons are often protected by galvanization. Subsequent embrittlement comes from the tempering galvanization treatment. Influence of the chemical composition of the iron. 7 ref. (Q26s, 2-60; CI-s, *Si, P*)

87-Q. (French.) **Several Tests on a Standard Specimen Ingot With Iron Wedge.** *Fonderie*, no. 139, Aug. 1957, p. 363-366.

Shapes of easy to produce specimen ingot investigated. The specimen gives homogeneous characteristics throughout. (Q27, S22; ST, 5-59)

88-Q. (French.) **Mechanical Tests for Cast Irons.** *Machine Moderne*, v. 51, p. 61-66.

Tensile tests; static bending tests; relation between the properties of a cast Fe and its bending resistance;

determination of the modulus of elasticity; shear, hardness and pressure tests; machinability.
(Q general; CI)

89-Q. (French.) **Study of Superficial Phenomenon Caused by the Drawing of Openhearth and Electric Steel.** Maurice Vauzelle. *Métaux-Corrosion-Industries*, no. 383-384, July-Aug. 1957, p. 269-285.

Hardness tests, X-ray diagrams and machining tests distinguish hardness variations caused by cold work, texture and internal stress. (To be continued.)
(Q29, G4; ST-e, ST-f)

90-Q. (German.) **Temper Brittleness of Structural Steel.** V. Kraus. *Fertigungstechnik*, v. 7, Aug. 1957, p. 367-372.

Tempering of different steel alloys; time-temperature effects; method for prevention of brittleness. 7 ref. (Q26s; J29; ST)

91-Q. (German.) **Investigation of the Strength of Copper-Titanium and Copper-Zirconium Alloys.** K. Dies. *Metall*, v. 11, Nov. 1957, p. 933-941. (CMA)

5 ref. (Q27a, Q7a; Cu, *Ti*, *Zr*)

92-Q. (Japanese.) **Effect of Excess Silicon in Aluminum-Magnesium-Silicon Alloys.** Hajime Yamada. *Light Metals*, v. 7, July 1957, p. 45-50.

Excess of Si in low-Mg alloys causes increased hardening, tensile strength, slight increase in electrical resistance and some increase in susceptibility to stress-corrosion. Aging time and corrosion resistance decreased. 3 ref.
(Q general; 2-60; Al, *Mg*, *Si*)

Corrosion

1-R. Reaction Rate Study of the Dissolution of Low-Hafnium Zirconium in Hydrofluoric Acid Solutions. G. R. Hill and T. Smith. *First Nuclear Engineering and Science Congress*, v. 2, 1957, p. 63-69. (CMA)

The rate at which zirconium dissolves in HF solutions studied by tracer methods and found to be dependent on free acid concentrations alone. Temperature coefficient averages 3.34 k-cal. per mole for high stirring rates. The most likely mechanism of the slow step is diffusion of HF to the zirconium surface, but three others are also considered. 11 ref. (R6g; Zr)

2-R. Oxidation Behavior of Reactor Materials. R. A. U. Huddle. *First Nuclear Engineering and Science Congress*, v. 1, 1957, p. 79-89.

Attempt to develop a theory of oxidation involving principles of crystal chemistry as opposed to electronic considerations which can be applied as a basis of alloying to improve oxidation resistance. Relation to oxidation behavior of nuclear fuels, canning materials, structural metals. 15 ref. (R1h, T11, 17-57)

3-R. Comparison of Sodium, Lithium, and Lead as Heat-Transfer Media From a Corrosion Standpoint. E. E. Hoffman and W. D. Manly. *First Nuclear Engineering and Science Congress*, v. 1, 1957, p. 128-137.

Types of corrosion which are found with the various liquid-metal container-material couples; corrosion mechanism and effect of various parameters on corrosion; best alloys for use with the three coolants. 5 ref.
(R6m; Na, Li, Pb, 14-60)

4-R. Corrosion Resistant Materials—Metals and Alloys (Continued). Lester F. Spencer. *Metal Finishing*, v. 55, Nov. 1957, p. 62-68.

Rates of attack of sulphuric and nitric acid and other corrodants on stainless steels, nickel and nickel-base alloys. Influence of concentration, temperature and oxidizing capacity of acid solution. 12 ref.
(R6g; SS, Ni)

5-R. Preliminary Report on Corrosion of Low-Uranium, Zirconium-Base Alloys. A. E. Dwight and A. H. Roebuck. Argonne National Laboratory. *U. S. Atomic Energy Commission*, ANL-5196, Oct. 1953, 30 p. (CMA)

The effects of heat treatment on the corrosion resistance of Zr-U alloys in 600° F. water vary with alloy composition. Tests on 57 compositions containing up to 9% U and some Sn, Pb, Sb, Bi, Y, Be, Ge, Cb, Ni and Al show best results with 2-6% U and 2-4% Sn. Water quenching gave best results for alloys made with crystal bar zirconium and alpha annealing the best for those made with sponge.
(R4, 2-62, 2-60, 2-64; Zr, *U*)

6-R. Corrosion Behavior of Some Zirconium and Titanium-Base Boron Alloys in High-Temperature Water. D. C. Belouin and Ulrich Merton. Knolls Atomic Power Laboratory. *U. S. Atomic Energy Commission*, KAPL-M-UM-6, June 15, 1956, 11 p. (CMA)

Good corrosion resistance in hot water was apparent for Ti-1.75B. Adding 0.4% B to Zircaloy-2 increased the corrosion rate, which showed a transition after 1000 hr.
(R4, 2-62; Zr, Ti, *B*)

7-R. Examination of Titanium Pulse Feeder Diaphragm Failure. T. M. Kegley, Jr. *U. S. Atomic Energy Commission*, CF-56-8-166, Aug. 24, 1956, 12 p. (CMA)

A diaphragm failed after 450 hr. service. One side of the diaphragm had been exposed to demineralized water and the other to a solution of UO_2SO_4. Both surfaces were covered with corrosion products, revealed by X-ray diffraction to be predominately TiO_2. Upon removal of the surface scale by brushing, the surface was found to be relatively unattacked. (R4, R6; Ti)

8-R. Examination of Recombiner Loop Specimens of Zr and Ti Alloys. M. K. Picklesimer. *U. S. Atomic Energy Commission*, CF-56-10-37, Oct. 2, 1956, 13 p. (CMA)

Samples of Ti, Zr, Zircaloy-2, Ti-6Al-4V and A-55 Ti were corroded in a recombiner loop. All showed some hydrogen pickup, especially Ti and Zr and all except Ti-6Al-4V showed recrystallization and grain growth. (R11, N3, N5; Zr, Ti)

9-R. Uniform Aqueous Corrosion of Aluminum—Effects of Various Ions. V. H. Troutner. Hanford Atomic Products Operation. *U. S. Atomic Energy Commission*, HW 50133, June 10, 1957, 53 p.

36 ref. (R4; Al)

10-R. (Norwegian.) **High-Temperature Oxidation of Metals and Alloys.** Per Kofstad. *Teknish Ukeblad*, v. 104, Mar. 28, 1957, p. 249-254.

Oxidation of pure metals, connection between transport of ions and electrons and oxidation rate; influence of small amounts of impurities on oxidation rate; oxidation of superalloys. 27 ref. (R2h, 3-69)

11-R. (Swedish.) **Corrosion in Car Bodies.** E. Br. *Teknisk tidskrift*, v. 87, Mar. 26, 1957, p. 299-300.

Research on nonprotective "deep rust" in protected parts of the motor car; influence of alloy materials on the sheet metal's resistance against different kinds of corrosion.
(R general, T21a; ST)

12-R. Corrosion in Engineering. *Corrosion Prevention and Control*, v. 4, Oct. 1957, p. 44-51.

Preventive measures. (R10)

13-R. Corrosion Engineering Research. *Corrosion Prevention and Control*, v. 4, Oct. 1957, p. 53-56.

Improved Li-based multipurpose greases; corrosive action of soluble cutting oils. (R7e; SGA-c, Li)

14-R. Cathodic Protection of Brewery Liquor Tanks. A. W. Hubbard. *Corrosion Prevention and Control*, v. 4, Oct. 1957, p. 57-58.

(R10d; CI)

15-R. Cathodic Protection in Isreal. Pt. 2. On Sea and in the Home. D. Spector. *Corrosion Technology*, v. 4, Sept. 1957, p. 306-309.

Cathodic protection of Israel's fishing fleet and household hot water boilers by means of magnesium anodes. (R10d; Mg)

16-R. Cathodic Protection of Underground Refinery Equipment. P. W. Sherwood. *Corrosion Technology*, v. 4, Sept. 1957, p. 313-317.

Basic elements of cathodic protection, methods used in accumulating data needed for designing protection system; choice of galvanic anodes for external power source; location and design of anodes. 5 ref. (R10d)

17-R. The British Iron and Steel Research Association. Pt. 1. Corrosion of Bare Ferrous Metal. J. C. Hudson. *Corrosion Technology*, v. 4, Sept. 1957, p. 320-324.

Tests on atmospheric corrosion of carbon and low-alloy steels under variety of climatic conditions; effects of atmospheric pollution and of small Cu or Cr additions to steel; corrosion in soil and sea water. (To be continued.)
(R3, R4, R8; ST, *Cu*, *Cr*)

18-R. High Temperature Oxidation of Silicon. J. T. Law. *Journal of Physical Chemistry*, v. 61, Sept. 1957, p. 1200-1205.

(R2h; Si)

19-R. The Corrosion Engineer and His Contribution to an Economic Underground Pipeline Project. Anthony Gross. *Pipes and Pipelines*, v. 2, Oct. 1957, p. 25-31.

(R8; 4-60)

20-R. Rusting and Its Cost to Farming. E. E. White. *World Crops*, v. 9, Oct. 1957, p. 406-409.

Examples, and methods of prevention in farm equipment.
(R general, T3)

21-R. (German.) **Resistance of Aluminum to Mortars.** E. Fischer and H. Vosskühler. *Aluminium*, v. 33, Sept. 1957, p. 606-612.

Resistance to corrosive agents in building materials can be increased by surface protection with lacquers, bituminous paints or greasing. 3 ref. (R6n; Al)

22-R. (German.) **Corrosion Resistance of Austenitic Chromium-Nickel Steels.** W. Katz. *Draht*, v. 8, Aug. 1957, p. 317-321.

Variations in composition permit adaption for many applications. 20 ref. (R general, 2-60; SS, *Cr*, *Ni*)

23-R. (German.) **White Scale on Zinc-Plated Products. Its Prevention.**

Karl Daeves. *Draht,* v. 8, Aug. 1957, p. 334-335.

White scale is a mixture of basic zinc carbonate and zinc oxide, caused by continued exposure to water. Sealing in oil paper and dipping in chromate solutions previous to shipping or storing was not satisfactory. Sufficient ventilation and prevention of excessive temperature fluctuation in storage rooms gave good results. 13 ref. (R2q; Zn, 8-62)

24-R. (Japanese.) **Effect of Manganese Dioxide on the Corrosion of Zinc Plates in Dry Cells.** K. Ninomiya and K. Sasaki. *Electrochemical Society of Japan, Journal,* v. 25, June 1957, p. 325-328.

Corrosion by managanese dioxide, oxygen and various metal ions. (R6; Zn)

25-R. (Russian.) **Texture of Iron Scale. Pt. 10. Texture of Ferrous Scale.** V. I. Arkharov and M. I. Simonova. *Fizika Metallov i Metallovedenie,* v. 4, no. 2, 1957, p. 278-290.

Oxidation conditions; measurement of crystalline lattice of ferrous oxide; X-ray photographs of ferrous oxide crystals. 8 ref. (R1h, R2q; Fe)

26-R. (Russian.) **Magnetostriction Vibrator Testing of the Effect of Shot Peening on the Cavitation-Corrosion Resistance of Metals.** L. A. Glikman and Yu. E. Zobachev. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 38-41.

Investigation did not disclose positive influence of shot peening on resistance to cavitation corrosion. 5 ref. (R2m, G23n)

27-R. (Russian.) **Corrosion Resistance of Metals to Natural Gas Containing Sulphuric Acid.** V. M. Nikiborova and N. A. Reshetkina. *Metallovedenie i Obrabotka Metallov,* no. 5, May 1957, p. 55-62.

Chromium plated steel and cast iron resist corrosion, while galvanized or aluminized gray cast iron does not. 8 ref. (R7k; ST, CI, 8-62, 8-65)

28-R. (Russian.) **Experience of Czechoslovak Industry in Protecting Equipment to be Exported to Tropical Countries.** A. V. Ryabchenkov, V. M. Nikiforova, N. B. Nezvanova and B. D. Samuylenko. *Metallovedenie i Obrabotka Metallov,* no. 6, June 1957, p. 59-63.

Various methods and materials used as protective covering on merchandise and machinery against exposure. Some protective coatings are heavily charged with fungicide. (R10f)

29-R.* Corrosion Control Methods. *American Gas Journal,* v. 184, Sept. 15, 1957, p. 98-99.

Coatings, extra pipe wall thickness, cathodic protection, combinations of these methods for protection for underground piping; types of cathodic protection equipment. (R10; 4-10)

30-R.* High-Temperature Oxidation and Contamination of Niobium. William D. Klopp, Chester T. Sims and Robert I. Jaffee. *American Society for Metals, Transactions,* v. 50, Preprint no. 64, 1957, 27 p.

Oxidation and contamination rates of Cb in oxygen and in air were measured in the temperature range 600 to 1200° C. The oxidation curves in oxygen were linear and the rate constants were correlated by an Arrhenius-type plot. The activation energy for diffusion of oxygen in Cb was calculated from contamination data. Contamination in air-reacted Cb was similar to that in oxygen-reacted Cb, suggesting that oxygen is the primary diffusing contaminant. 13 ref. (R1h, N1; Cb)

31-R.* Corrosion, Pyrophoricity, and Stress-Corrosion Cracking of Titanium Alloys in Fuming Nitric Acid. J. B. Rittenhouse. *American Society for Metals, Transactions,* v. 51, Preprint no. 68, 1957, 43 p. (CMA)

Studies of the attack of fuming HNO_3 on Ti and Ti-8Mn showed that ignition sensitivity depended on the presence of fine particles on the surface, that stress-corrosion cracking occurred in Ti when the NO_2 content exceeded 6.5% (H_2O less than 0.7%) and in Ti-8Mn when NO_2 exceeded 0% (H_2O less than 0.8%). The corrosion-time relations of the metals in fuming HNO_3 with 20% NO_2 were measured in the range 25-71° C. 18 ref. (R6g, R1d; Ti)

32-R.* Studies of the Oxidation and Contamination Resistance of Binary Niobium Alloys. Chester T. Sims, William D. Klopp and Robert I. Jaffee. *American Society for Metals, Transactions,* v. 51, Preprint no. 70, 1957, 33 p.

Effects of binary alloying additions. The alloys contained up to 35 at. % Ti, Cr and Zr, 25 at. % V, Mo, Ta and W, and 5 at. % Be, B, Co, Fe, Mn, Ni and Si. The oxidation and contamination studies were conducted in air at 600, 800 and 1000° C. 8 ref. (R1h, 2-60; Cb)

33-R.* Stress-Corrosion Cracking of Insulated Austenitic Stainless Steel. A. W. Dana, Jr. *ASTM Bulletin,* no. 225, Oct. 1957, p. 46-52.

Stress-corrosion cracking which may occur when austenitic stainless steel piping is exposed to moist thermal insulating materials is believed to result from the action of water-soluble chlorides leached from the insulations. Chemical analyses showed that water-soluble chlorides are present in 85% magnesia, calcium silicate and glass fiber insulating materials, with little difference in chloride level between them. (R1d, R6; SS, 4-60)

34-R.* Resistance of Cast Iron to Cavitation Erosion. R. I. Higgins. *British Cast Iron Research Association Journal of Research and Development,* v. 7, Oct. 1957, p. 28-53.

Tests carried out on the jet impact machine and the magnetostriction apparatus. In the jet impact machine the specimens are rotated at a high speed through a jet of water. The calculated impact pressure is about 7.5 tons per sq. in. In the magnetostriction apparatus the specimen is vibrated in water at a high frequency (10,000 cycles per sec.) but through a very small amplitude. 8 ref. (R2m, 1-53; CI)

35-R. Corrosion of Metals in Buildings. R. W. Bailey and H. G. Ridge. *Chemistry and Industry,* v. 76, Sept. 1957, p. 1222-1227.

Performance of Zn and Zn sheet products in and on buildings, with steel protected from rust by means of a Zn coating, and with the behavior of Zn alloy die-cast builders' hardware. 16 ref. (R3, T26n; Zn)

36-R. A Review of Telephone Cable Corrosion Problems. *Corrosion,* v. 13, Oct. 1957, p. 134-137.

Usual practice and problems with suggestions for improving methods in making surveys of bare ducted cables. (R8, T1b; Pb)

37-R. Use of Stainless Steel to Combat Corrosion in the Chemical Industry. Pt. 2. *Corrosion,* v. 13, Oct. 1957, p. 138-146.

Pitting, concentration cell attack, sensitization, stress-corrosion cracking and hot shortness in stainless steels; relative susceptibility of common types to these defects; examples of failure. 26 ref. (R2; SS)

38-R. Artificial Insulating Joints for Stray Current Mitigative Measurements. G. H. Cantwell. *Corrosion,* v. 13, Oct. 1957, p. 616t-618t.

Method for applying direct current between structure and earth simulating an insulating joint making it possible to determine effect of insulating joint without placing temporary joints. (R1g)

39-R.* Corrosion of Austenitic Stainless Steels in Sulfuric Acid. E. H. Phelps and D. C. Vreeland. *Corrosion,* v. 13, Oct. 1957, p. 619t-624t.

Corrosion resistance of AISI Types 304, 310, 316, 317, 321 and 347 in saturated sulphuric acid solution at 30°, 50° and 70° C. Results presented in terms of "active passive" regions. Use of potential measurements for determination. 6 ref. (R6g; SS)

40-R. Standardization in the Field of Corrosion and Corrosion Protection in Germany. *Corrosion,* v. 13, Oct. 1957, p. 625t-626t.

Tabulates status of German standardization relating to corrosion, corrosion protection by chemical, electrochemical or galvanic coating and testing of metallic industrial materials. (R10, R11, S22)

41-R.* Corrosion and Metal Transport in Fused Sodium Hydroxide. Pt. 2. Corrosion of Nickel-Molybdenum-Iron Alloys. G. Pedro Smith and Eugene E. Hoffman. *Corrosion,* v. 13, Oct. 1957, p. 627t-630t.

Study of corrosion by fused sodium hydroxide of nickel-rich alloys at 815° C. for 100 hr.; reaction mechanism with Ni-Mo and Fe alloys found to involve removal of Fe and Mo from solid solutions with Ni. 8 ref. (R6s, R1; Ni, Mo, Fe)

42-R.* Sulfide Corrosion Cracking of High-Strength Bolting Material. Donald Warren and G. W. Beckman. *Corrosion,* v. 13, Oct. 1957, p. 631t-646t.

Behavior of AISI Type 4140 bolts in aqueous H_2S systems at 20 to 120° C. and pressures of 1 to 17 atm.; effect of bolt hardness, stress and plastic deformation; protection by metallic coating and corrosion inhibitors, mechanism of corrosion cracking of 4140 bolts. 24 ref. (R6g, T7f; AY)

43-R. Titanium, Zirconium and Tantalum for Control of Corrosion. William E. Lusby, Jr. *Corrosion,* v. 13, Oct. 1957, p. 654t-658t.

Corrosion resistant properties and progress in process application. 20 ref. (R general; Ti, Zr, Ta)

44-R.* High Alloys to Combat Corrosion. E. D. Weisert. *Corrosion,* v. 13, Oct. 1957, p. 659t-671t.

Corrosion resistant properties, mechanical properties, welding characteristics, general fabrication characteristics and heat treatment of Ni-Mo, Ni-Mo-Cr, Ni-Cr-Fe-Mo, Co-W-Ni, Co-W-C, Fe-Si, Fe-Si-Mo, and Ni-Si alloys. Applications in highly corrosive conditions in industries. 32 ref. (R general; SGA-g)

45-R.* Quantitative Comparison of Surface Finishes and Heat Treatment

of Stainless Steel With Respect to Corrosion by Jet Fuels. R. G. Carlson. *Corrosion,* v. 13, Oct. 1957, p. 672t-676t.

Samples of AISI 440° C. stainless steel were hardened and tempered at different temperatures and given one of five different surface finishes and subjected to corrosive environment consisting of JP-4 fuel above water. Corrosion rates found for different surfaces and tempering treatments. (R7d, 2-64; SS)

46-R.* Growth of Ferrous Sulfide on Iron. R. A. Meussner and C. E. Birchenall. *Corrosion,* v. 13, Oct. 1957, p. 677t-689t.

Rate and nature of growth in sulphur vapor between 650 and 900° C. with vapor pressure of 10 to 500 mm. of mercury. Self-diffusion coefficient calculated for iron ions. 16 ref. (R6p, N1d; Fe)

47-R.* A Laboratory Study of N-Oleoyl Sarcosine as a Rust Inhibitor in Some Petroleum Products. Robert M. Pines and John D. Spivack. *Corrosion,* v. 13, Oct. 1957, p. 690t-694t.

Effectiveness of inhibitor in gasoline, mineral oil or silicon lubricants in preventing corrosion of steel specimens; provides effective inhibition under static and dynamic immersion test as well as in presence of humid atmospheres. 12 ref. (R10b, R11; ST)

48-R.* Plastic Flow of Iron Oxides and the Oxidation of Iron. J. D. Mackenzie and C. E. Birchenall. *Corrosion,* v. 13, Dec. 1957, p. 783t-785t.

Under certain conditions, the oxidation of Fe in oxygen at high temperatures is accompanied by the formation of a central box-like cavity the dimensions of which are identical to those of the original Fe specimen. The decrease in size of this cavity with increasing temperature and its disappearance when the formation of magnetite and hematite is excluded by a controlled oxidizing potential indicate the plastic properties of the oxides to be an important factor. Measurement of the relative plasticity of the three oxides at 800-1000° C. in a specially designed apparatus confirms this. 7 ref. (R1h; Fe)

49-R. Compatibility of Aluminum With Alkaline Building Products. C. J. Walton, F. L. McGeary and E. T. Englehart. *Corrosion,* v. 13, Dec. 1957, p. 807t-816t.

Tests under a variety of conditions. Chemistry of reactions between Al and alkaline building products; results of a series of laboratory tests. Aluminum corrodes only superficially and this corrosion is self-limiting in nature. 9 ref. (R1, R6; Al)

50-R.* Polarization in the Corrosion of Ice Breakers. J. H. Greenblatt. *Corrosion,* v. 13, Dec. 1957, p. 817t-820t.

Measurement of polarization characteristics of steel coupons subjected to the usual treatments given ship plating indicates that cathodic depolarization is the major factor influencing corrosion. At low temperatures in oxygenated water considerable anodic polarization occurred which would tend to mitigate corrosion. Results discussed in terms of observed corrosion patterns on the hulls of vessels operating in ice. (R1, R4; T22g)

51-R. Inhibiting Effect of Hydrofluoric Acid in Fuming Nitric Acid on Liquid and Gas Phase Corrosion of Several Metals. David M. Mason, Lois L. Taylor and John B. Rittenhouse. *Corrosion,* v. 13, Dec. 1957, p. 821t-827t.

Measurements at 130° F. of corrosion of several metals exposed to the liquid and the gas phase of thermally stable nitric acid containing 11 to 13% NO_2 and 2 to 4% water with and without hydrofluoric acid added as a corrosion inhibitor. 7 ref. (R6g, R10b)

52-R.* Fretting Corrosion as an Engineering Problem. K. H. R. Wright. *Corrosion Prevention and Control,* v. 4, Nov. 1957, p. 37-44.

Characteristics and mechanism of fretting corrosion; surface treatments and lubrication; fretting corrosion and fatigue. (R1f)

53-R.* Black Oxide Coatings on Steel: Quality Tests. J. Doss. *Electroplating and Metal Finishing,* v. 10, Sept. 1957, p. 289-290.

Steel panels treated in aqueous alkaline oxidizing bath to produce black magnetic oxide coatings were tested by oxalic acid, imbibation, humidity cabinet, citrate tests. The oxalic acid spot test found most reliable. (R11, L14a; ST)

54-R. Influence of Surface Pretreatment on the Atmospheric Oxidation of 2S (U. S. Alloy 1100) Aluminum. Philip M. Aziz and Hugh P. Godard. *Electrochemical Society, Journal,* v. 104, Dec. 1957, p. 738-739. (R1h, 3-70; Al)

55-R.* Recent Metallurgical Problems in Marine Engineering. B. Tood. *Institute of Marine Engineers, Transactions,* v. 69, Aug. 1957, p. 320-325.

Examples of corrosion of condenser tubes, propeller shaft liners, ships' side valves of spheroidal graphite iron; brittle fracture of wrought iron anchor cables; fatigue failure of diesel engine pistons of spheroidal graphite iron; causes and preventives. 11 ref. (R4b, Q26s, Q7, T22; CI)

56-R.* Stopping Corrosion With Rust Preventive Compounds. R. P. Mills. *Iron and Steel Engineer,* v. 34, Sept. 1957, p. 96-100.

Nature of corrosion and its prevention by petroleum rust preventive compounds. (R10b)

57-R.* Corrosion Resistant Materials—Metals and Alloys. Pt. 2. Lester F. Spencer. *Metal Finishing,* v. 55, Nov. 1957, p. 62-68.

Effect on Types 430, 302, 304, 347 stainless steels and nickel alloys of a variety of acid solutions. 12 ref. (R6g; SS, Ni)

58-R.* Scaling of Billets. Pt. 3. J. Moreau and M. Cagnet. *Metal Treatment and Drop Forging,* v. 24, Nov. 1957, p. 456-458.

Ordinary bessemer, oxygen bessemer and openhearth steels were studied. Influence of reheating time on total thickness of the scale, depth of contamination and decarburization; influence of reheating temperature, furnace atmosphere and quality of steel. 8 ref. (R2q; ST, 4-52)

59-R. Corrosion in 650° F. Degassed Water of Uranium-Molybdenum Alloys Containing Impurity Additions. E. W. Cawthorne, et al. Battelle Memorial Institute. *U. S. Atomic Energy Commission,* BMI-1045, Oct. 6, 1955, 6 p. (CMA)

(R4d; U, *Mo*)

60-R. Investigation of Scaling of Zirconium at Elevated Temperatures. Quarterly Status Report No. 16 for Mar. 2, 1957 to June 2, 1957. H. B. Prebst, E. B. Evans and W. M. Baldwin, Jr. *U. S. Atomic Energy Commission,* AECU-3529, June 6, 1957, 5 p. (CMA)

(R2q; Zr)

61-R. Scaling of Zirconium and Zirconium Alloys. J. A. Burka, C. S. Crouse and R. E. Swift. *U. S. Atomic Energy Commission,* AECU-3661, Aug. 1957, 40 p. (CMA)

11 ref. (R2q; Zr)

62-R. (French.) **Electrochemistry and Corrosion.** M. Pourbaix. *Corrosion et Anticorrosion,* v. 5, no. 9, Sept. 1957, p. 230-240.

Fundamental research in thermodynamics and electrochemical kinetics applied to corrosion. General conditions of electrochemical equilibrium between metals and their oxides and theoretical conditions of corrosion plotted in diagrams versus the pH of the solution. The thermodynamic study of polarization curves gives a precise idea of the possibility of corrosion in many cases. (R1)

63-R. (French.) **General Aspects of the Theory of Corrosion.** R. Piontelli. *Corrosion et Anticorrosion,* v. 5, no. 9, Sept. 1957, p. 241-243.

The concepts of total work of transformation and resistance of transformation. Definitions of immunity, cathodic protection and passivity. (R1, R10, 10-51)

64-R. (French.) **The Corrosion Engineer as a "Planner".** Jacques Baudin. *Corrosion et Anticorrosion,* v. 5, Oct. 1957, p. 269-274.

Duties of corrosion protection departments in manufacturing plants, their relation to other departments. (R general, A5b)

65-R.* (French.) **Corrosion Phenomena in Tubular Condensers. Some Typical Examples, Preventives and Correctives.** A. J. Maurin. *Corrosion et Anticorrosion,* v. 5, Oct. 1957, p. 275-285.

Definition and description of a tubular condenser. Detailed analysis of cases of salt water corrosion in Texas plants of Dow Chemical Co. involving condenser elements in Cu, Cu alloy, steel, cast Fe, Al brass and Muntz metal as influenced by chlorination, cathodic protection, protective coverings, speed of circulation of water, presence of air, filtration of system water, periodic cleaning of system, iron content of water, respective locations of parts subject to corrosion. (To be continued.) (R4b, T1e; Cu, ST, CI)

66-R.* (French.) **Electrochemistry and Corrosion.** (Concluded.) M. Pourbaix. *Corrosion et Anticorrosion,* v. 5, Oct. 1957, p. 286-293.

Corrosion behavior of Fe in bicarbonate of sodium solutions of varying pH; of 18-8 stainless steel in acetic and acetate solutions with and without NaCl; influence of chlorides and phosphates on corrosion of Fe and common steel; conditions required for passivation; practical application of theories deduced from observations (e.g., corrosion protection of reinforcement Fe in concrete towers for overhead electric lines); methods of calculating corrosion rate of metals and alloys used in nuclear reactors, boilers, autoclaves, etc., at high temperatures and pressures. 42 ref. (R1, R2; ST, CI)

67-R. (French.) **Protection of Cables Against Corrosion.** M. Osty. *Corrosion et Anticorrosion,* v. 5, Oct. 1957, p. 294-298.

Water-tight coatings in various plastic materials of in asphalt-glass base composition have proved their effectivness on samples of cable subjected to an electrolytic action in an acid medium.
(R7b, L26p, L26c; NM-g)

68-R. (French.) **Influence of Oxidation on the Superficial Chemical Composition of Refractory Alloys.** F. Malamand and G. Vidal. *Métaux-Corrosion-Industries,* no. 383-384, July-Aug. 1957, p. 286-299.

Study of oxidation by determination of superficial modification of chemical composition of the metallic layer underlying the oxide layer. Spectrographic method used in the case of refractory alloys (nimonic), from gas turbines. 22 ref.
(R1h, S11k; EG-d, Ni)

69-R. (French.) **Prevention of Corrosion by Brine.** A. Maringe. *Revue Pratique du Froid,* no. 138, p. 41-44.

Typical cases of corrosion by cooling solution systems in breweries and ice plants; study of corrosion causes, remedies, preventives.
(R4f, R10, W10g)

70-R. (German.) **Stress-Corrosion Testing Methods for Brass Compared With Long-Term-Storage Tests.** S. Hellsing, O. Lissner, S. Rask and B. Strom. *Werkstoffe und Korrosion,* v. 8, Oct. 1957, p. 569-573.

Mercury nitrate and ammonia tests are more severe than two years of storage (cartridge cases under rain shelters). 13 ref.
(R11s, 1-15; Cu)

71-R. (German.) **Influence of Trace Elements on Anti-Scaling Properties of Heat Resistant Alloys.** H. Pfeiffer. *Werkstoffe und Korrosion,* v. 8, Oct. 1957, p. 574-579.

Ca and Ce among other trace elements impart improved oxidation resistance; effectiveness is caused by an increased adhesiveness of the oxide layer which is formed during high-temperature heating. Results of X-ray, photographic and supermicroscopic investigations of the formation of oxide layers on Fe-Cr-Al alloys. 20 ref.
(R2q; 2-60; SGA-h, AD-n)

72-R.* (German.) **Austenitic Corrosion Resistant Nickel-Molybdenum Cast Alloys.** W. Gödecke. *Werkstoffe und Korrosion,* v. 8, Oct. 1957, p. 580-587.

Hastelloys of B and C types were subjected to electrochemical and metallographic investigation. The former could not be passivated while the latter showed some passivation inclination. Phase structure showed improved coefficients of extension, tenacity, plastic deformation and workability. Corrosion resistance and electrochemical properties of the one-phase solid solution B and C types were equal to the intermetallic two-phase commercial hastelloy.
(R10c, P15, 2-60; Ni, Mo)

73-R. (German.) **Corrosion in High-Temperature Boilers.** Max Werner. *Werkstoffe und Korrosion,* v. 8, Oct. 1957, p. 587-596.

Experience with corrosion of highly heat resistant steels in 600° boilers after 40.000 hr. of operation.
(R2q, R4c; 2-62, 3-67; SS)

74-R. (German.) **New Methods of Iron Protection in Soils.** T. Markovic. *Werkstoffe und Korrosion,* v. 8, Oct. 1957, p. 596-602.

Soil structure; ratio of soil water to soil air; artificial aeration cells. 19 ref. (R8, R10; 2-60; Fe)

75-R. (German.) **Rubber for Protection Against Corrosion.** *Werkstoffe und Korrosion,* v. 8, Oct. 1957, p. 603-606.

A survey of mechanical and chemical properties of rubber coatings on pipe. (R10f, L26; NM-g

76-R. (French-German.) **Antirust Coatings and Welding.** R. Clément. *Zeitschrift für Schweisstechnik,* v. 47, Sept. 1957, p. 212-219.

On welded constructions, the antirust coatings are very often altered along welds. The cause is a carbonate deposit. Means to aviod this corrosion. (R general; 7-51)

77-R. (Japanese.) **On the Corrosion Resistance of Titanium Alloys. Pt. I. Relation Between the Corrosion Resistance and the Electrode Potentials of Titanium Alloys.** Hideo Nishimura and Tsuyoshi Hiramatsu. *Japan Institute of Metals, Journal,* v. 21, July 1957, p. 465-469. (CMA)

A corrosion resistance study of alpha and beta solid-solution binary alloys of titanium in 20% HCl. Electrode potentials and time-potential curves were measured. Effects of alloy additives on corrosion resistance to HCl, H_2SO_4 and oxalic acid at different concentrations and temperatures. (R6g; Ti)

78-R. (Japanese.) **Corrosion Resistance of 28 Aluminum in Hot Water With Respect to the Ratio of Its Iron and Silicon Content.** Yoshitsugu Mishima. *Light Metals,* v. 7, July 1957, p. 51-57.

28 Al-containing Fe and Si in 4:1 ratio has good corrosion resistance to water at 120-300° C. for reactor applications. 5 ref.
(R4d; 2-60; Al)

79-R. (Japanese.) **Corrosion Resistance of Aluminum and Its Alloys in High-Temperature Water.** Yuzo Nakamura, Satoshi Sugino and Motoi Nishizaka. *Light Metals,* v. 7, July 1957, p. 58-64.

Ni, Co, Fe or Mn improve corrosion resistance; Ni is most effective. (R4d, 2-60)

8 Inspection and Control

1-S. Procedures for Chemical Analysis of 7% Uranium-Zircaloy. J. Rynasiewicz. Knolls Atomic Power Laboratory. *U. S. Atomic Energy Commission,* KAPL-M-JR-6, May 31, 1956, 20 p. (CMA)

Procedures for determining U (titrimetrically); Fe (volumetrically); Ni (colorimetrically); Cr (colorimetrically); Sn (polarographically); and N (micro-Kjeldahl).
(S11; U, Zr)

2-S. Non-Destructive Tests on 2½-In. Titanium Pipe and Housing for Centrifugual Pump. J. P. Hammond and T. M. Kegley. *U. S. Atomic Energy Commission,* CF-56-10-27, Oct. 4, 1956, 4 p. (CMA)

Titanium pipe considered off grade was evaluated for soundness and surface quality by ultrasonic and radiographic techniques and metallographic examination. Surface defects were found but the pipe (and the housing fabricated from it) were reported otherwise sound. (S13; Ti)

3-S. Determination of Zirconium in Plutonium by Ion Exchange and Spectrography. Roy Ko. Hanford Works. *U. S. Atomic Energy Commission,* HW-51831, Aug. 5, 1957, 9 p. (CMA)

Impurity amount of zirconium can be separated from plutonium by anion exchange of the plutonium nitrate complex. The combined effluent and wash solution is analyzed for zirconium by graphite spark excitation, using cobalt as the external standard. 14 ref.
(S11f, S11k; Pu, *Zr*)

4-S. New Spectrophotometric Determination of Titanium With Sodium Alizarinsulfonate. Hidehiro Goto, Yachiyo Kakita and Michiko Namiki. *Tohoku University, Research Institutes, Science Reports, Series A (Physics, Chemistry and Metallurgy),* v. 9, Aug. 1957, p. 245-252. (CMA)

Method is based on the green color resulting when titanium is introduced into a solution of sodium alizarinsulphonate and $SnCl_2$ in HCl solution. 4 ref. (S11a; Ti)

5-S. (Russian.) **Surface Inspection of Wire Rod by the Magnetic Suspension Method.** E. I. Andreev and V. N. Gulyakova. *StaP,* v. 17, May 1957, p. 456-457.

Method consists of placing the sample in a bath holding magnetic particles in suspension which deposit along imperfections on the surface of the magnetized sample. Rod within the range of 6-8 mm. can be inspected with complete satisfaction as to quality and efficiency.
(S13j; ST, 4-55)

6-S. Determination of Antimony in Cast Iron. R. C. Rooney. *Analyst,* v. 82, Sept. 1957, p. 619-623.

Sample is dissolved in nitric acid under controlled conditions. 12 ref.
(S11j; CI, *SG*)

7-S. Volumetric Determination of Tin in Titanium and Its Alloys. H. J. G. Challis and J. T. Jones. *Analyst,* v. 82, Oct. 1957, p. 658-663. (CMA)

5 ref. (S11j; *Sn*, Ti)

8-S. Determination of Boron in Titanium Alloys by Ion Exchange Method. E. G. Newstead and J. E. Gulbierz. *Analytical Chemistry,* v. 29, Nov. 1957, p. 1673-1674. (CMA)

12 ref. (S11f; *B*, Ti)

9-S. Uses of Statistical Methods for Ultrasonic Inspection Problems. M. J. Bratt. *Nondestructive Testing,* v. 15, Sept.-Oct. 1957, p. 282-287.

Basic concepts of statistics and use of statistical methods in analyzing data in typical problems.
(S13g, S12)

10-S. Relative Advantage and Limitation of Nondestructive Testing Methods. L. vanOuwerkerk. *Nondestructive Testing,* v. 15, Sept-Oct. 1957, p. 298-312.

Includes radiography, ultrasonics and magnetic particle penetrant methods. (S13)

11-S. (German.) **Determination of Silicon in Steel and Cast Iron Wire. New Filter and Combustion Sleeves.** Gisela Lingelbach. *Giessereitechnik,* v. 3, June 1957, p. 133-134.

(S11, ST, CI, *Si*, 4-61)

12-S. (German.) **Crankshaft Strength.** A. Theodor Wuppermann. *Stahl und Eisen,* v. 77, Aug. 22, 1957, p. 1117-1122.

Longitudinal surface defects are detected by nondestructive tests. 4 ref. (S13, T21c)

13-S. (German.) **Additional Data on the Gas Content of Lead.** Wilhelm Hofmann and Jürgen Maatsch. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 10, July 1957, p. 313-317.

Degassing of lead under vacuum resulted in gas contents of 1/10 NM1/100 g. melted material. The gas consisted mainly of steam and CO_2, which are formed by a reac-

tion of carbon and hydrogen penetrating from the outside and oxygen in the melt. 14 ref. (S11r, E25s; Pb)

14-S. Micro Volumetric Determination of Uranium With Application to Bismuth Base Alloy Analysis. G. W. C. Milner and G. A. Barnett. *Analytica Chimica Acta,* v. 17, Aug. 1957, p. 220-225.

Macro volumetric method for the determination of U by titration against standard ceric sulphate after reduction on a Pb column has been successfully applied on the micro scale to analysis of Bi-base alloys containing U in concentrations from 0.005 to 0.1% by weight. 5 ref. (S11d; *U,* Bi)

15-S. Ion Exchange Separations in the Anaylsis of Bismuth Base Alloys. Pt. 1. Binary Alloys With Uranium and Thorium. G. W. C. Milner and J. W. Edwards. *Analytica Chimica Acta,* v. 17, Aug. 1957, p. 259-263.

Separation and reduction techniques are supplemented by volumetric and absorptiometric procedures for determination of U (0.001-10%) + Th (0.05-10%) in binary mixtures with Bi. 7 ref. (S11f; U, Th, *Bi*)

16-S. Titanium Arc Furnace Operation Controlled by Atomic Radiations. *Industrial Heating,* v. 24, Oct. 1957, p. 2018, 2026. (CMA)

Gamma rays are being used to detect and control the level of molten titanium in a "cold hearth" arc furnace; a needle of Co-60 is the source of gamma-rays which pass through the ingot. (S18q, W18s; Ti, *Co*)

17-S. Radioisotopes: Use Them on Tough Problems. C. M. Crompton. *Iron Age,* v. 180, Oct. 17, 1957, p. 111-114.

Radioisotopes find application in sheet, strip and film gaging, flaw detection and basic research. (S13, S14, A9; 14-63)

18-S. Application of Static Switching in the Steel Industry. D. L. Pierce. *Iron and Steel Engineer,* v. 34, Nov. 1957, p. 113-125.

Instrumentation and control in steel mills. (S16, S18, W23; ST)

19-S.* SNT Airframe Committee Report on Reproducibility of Ultrasonic Inspection Test Results. Z. J. Varney and R. E. Kleint. *Nondestructive Testing,* v. 15, Sept-Oct. 1957, p. 290-292.

Results of ultrasonic detection and evaluation tests for defects in 7075 Al alloy plate performed by 27 different organizations. (S13g; Al)

20-S. Status Report on Core-3 Hafnium Control Rods. E. D. Baugh and H. B. Hunter. Westinghouse Atomic Power Division, *U. S. Atomic Energy Commission,* WAPD-FEM-60, Feb. 11, 1955, 9 p. (CMA)

Control rods were fabricated of Hf ingots and studied to determine the source and result of contamination. Welding was the source of about 750 ppm. w; Ni is a minor impurity. Contaminated platelets are more likely to crack in cold rolling. (S13, T11j; Hf)

21-S. Determination of Tin in Zirconium-Base Alloys. T. C. Bryson, et al. Westinghouse Atomic Power Division. *U. S. Atomic Energy Commission,* WAPD-CTA(GLA)-371, Apr. 18, 1957, 4 p. (CMA)

(S11j; *Sn,* Zr)

22-S. Leak Prevention—Through In-Process Leak Detection. Richard P. Turner. *Welding Journal,* v. 36, Dec. 1957, p. 1167-1171.

Use of fluorescent penetrants and fluorescent additives in tank and vessel inspection. (S13, T26q)

23-S. (Pamphlet.) **Steel Products Manual: Steel Tubular Products.** 155 p. Sept. 1957. American Iron and Steel Institute, 150 E. 42nd St., New York 17, N. Y.

Dimensions, tolerances, chemical analysis, nomenclature and sampling of steel tubing, stainless steel tubing and steel pipe. (S22; ST, SS, 4-60)

24-S. (Pamphlet.) **Steel Products Manual: Hot Rolled Carbon Steel Strip.** 26 p. Oct. 1957. American Iron and Steel Institute, 150 E. 42nd St., New York 17, N. Y.

Dimensions, tolerances, chemical analysis, nomenclature and sampling of hot rolled carbon steel strip. (S22; CN, 4-53, 1-66)

25-S. (Pamphlet.) **Steel Products Manual: Cold Rolled Carbon Steel Strip.** 27 p. Oct. 1957. American Iron and Steel Institute, 150 E. 42nd St., New York 17, N. Y.

Dimensions, tolerances, chemical analysis, nomenclature and sampling of cold rolled carbon steel strip. (S22; CN, 4-53, 1-66)

26-S. (Pamphlet.) **Steel Products Manual: Tin Mill Products.** 34 p. Oct. 1957. American Iron and Steel Institute, 150 E. 42nd St., New York 17, N. Y.

Dimensions, tolerances, chemical analysis, nomenclature and sampling of tin plate, black plate, terne plate, blued plate and hollow-ware enameling stock. (S22, ST, *Sn,* 8-62, 8-66)

27-S. (Czech.) **Control and Recording of Temperatures During Pouring and Solidification of Steel.** Lubomir Smrha and Rostislav Hluzin. *Hutnické Listy,* v. 12, 1957, p. 711-714.

Good result in measuring liquids and solidifying steel temperatures obtained with Pt-Rh thermocouple in protective quartz capillary tubes; mechanical high-speed recorder used for recording temperatures. (S16j, X9q; ST)

28-S. (Czech.) **List of Terms Connected With Spectroscopic Analysis and Their Equivalent in Czech, Russian, German, Polish, French and English.** Josef Kuba. *Hutnické Listy,* v. 12, 1957, p. 715-718.

(S11k; 11-67)

29-S. (French.) **Applications of Radioactivity in the Light Industry.** F. Rohner. *Aluminium Suisse,* v. 5, Sept. 1957, p. 174-181.

Applications of radiotracers and autoradiography. Nondestructive tests; analysis by activation. Proportional Geiger-Muller counters are more and more employed for measuring radiation. (S19, X8, X2; Al, Mg)

30-S. (German.) **Determination of Small Amounts of Titanium in Iron Alloys and Ores After Separation of the Heavy Metals by Pyrrolidinedithiocarbamate.** Ernst Schoeffmann and Hanns Malissa. *Archiv für das Eisenhüttenwesen,* v. 28, Oct. 1957, p. 623-624. (CMA)

(S11; *Ti,* Fe)

31-S. (German.) **Rapid Photometric Determination of Titanium in Copper Alloys.** H. Wiedmann. *Metall,* v. 11, Nov. 1957, p. 942-943. (CMA)

2 ref. (S11a; Au, *Ti*)

32-S.* (German.) **Rimming Steel.** Hubert Hoff, Georg von der Dunk and Heinz Lessing. *Stahl und Eisen,* v. 77, Sept. 1957, p. 1210-1215.

Determination of the nonmetallic inclusions in steel ingots made from rimming-type, free-cutting steel. (S13b, D9p, G17k; 2-60; ST-d)

33-S. (German.) **Automatic Testing of Billets by Magnetic and Ultrasonic Methods.** Vladimir Husarek. *Stahl und Eisen,* v. 77, Oct. 1957, p. 1483-1487.

Experimental assembly for testing steel billets simultaneously by electromagnetic and ultrasonic methods; applications in a wire rod mill; results with billets rolled from basic bessemer low-carbon steel. Design of an automatic testing assembly. (S13g, S13h; CN-g, 4-52, 4-55)

34-S. (German.) **Spectrometrical Analysis of Steel.** Gerhard Hartleif. *Stahl und Eisen,* v. 77, Oct. 1957, p. 1497-1499.

Determination of C, P, S and gases in steel; sample preparation; excitation; selection of the spectrum lines; optical stability of the apparatus; evaluation. 7 ref. (S11k; ST)

35-S. (German.) **Indirect Volumetric Determination of Molybdenum With Ethylenediamine Tetraacetic Acid.** E. Lassner and H. Schlesinger. *Zeitschrift für Analytische Chemie,* v. 158, no. 3, 1957, p. 195-198. (CMA)

4 ref. (S11j; *Mo*)

36-S. (Japanese.) **Inspection of Aluminum Slab by Supersonic Waves.** T. Morinaga and T. Takahashi. *Casting Institute of Japan, Journal,* v. 29, July 1957, p. 508-514.

Location of large blisters on rolled and annealed plate. (S13g; Al, 9-71)

37-S. (Japanese.) **Preparation of Sample for Chemical Analysis of Sponge Titanium.** Kazukiyo Ohashi, Tsuyoshi Nakayama and Kameji Shimasaki. *Japan Analyst,* v. 6, Sept. 1957, p. 572-579. (CMA)

(S12h, S11; Ti, 6-74)

38-S. (Spanish.) **Determination of Small Amounts of Aluminum in Titanium.** M. E. Bertin and A. H. Guerrero. *Associacion Quimica Argentina, Annales,* v. 45, June 1957, p. 121-125. (CMA)

7 ref. (S11j; *Al,* Ti)

Metal Products and Parts

1-T. Niobium-Uranium Alloys as Container Material for Molten Uranium Eutectic Alloys. G. W. Powell. Nuclear Metals, Inc. *U. S. Atomic Energy Commission,* NMI-1183, Aug. 22, 1957, 20 p.

(T11, 17-57; Cb-U)

2-T. Boron-Aluminum and Boron-Uranium-Aluminum Alloys for Reactor Application. W. C. Thurber, J. A. Milko and R. J. Beaver. Oak Ridge National Laboratory. *U. S. Atomic Energy Commission,* ORNL-2149, Oct. 17, 1957, 23 p.

7 ref. (T11, R4, 17-57; B, Al, U)

3-T. (German.) **Welding Versus Casting.** F. Paschke. *Giesserei-Praxis,* v. 75, Sept. 30, 1957, p. 413-415.

Advantages in quality and cost of castings for machinery and construction parts. (T7, 17-7; 5, 7-51)

4-T. (Norwegian.) **Clad Metal Plate. Manufacturing and Use in Chemical Industry.** Alf Franzén. *Teknisk Ukeblad,* v. 104, Mar. 14, 1957, p. 211-218.

Clad metal plate of stainless steel, nickel and monel is used in chemical industry particularly for construction of pressure vessels. Manu-

facture according to Colville's methods; types of plate and test methods; applications, welding and finishing; use of clad metal plate in cellulose and other chemical industries. (T29, 17-57; SS, Ni, 8-66)

5-T. (Norwegian.) **Magnesium and Its Industrial Use.** F. Dyngvold. *Teknisk Ukeblad,* v. 104, Apr. 18, 1957, p. 313-314.

Magnesium and its alloys, use in industry, particularly in motor and aircraft manufacturing. (T24, W11q, 17-57; Mg)

6-T. Armco Develops New Steel for Aircraft and Missiles. *Automotive Industries,* v. 117, Sept. 15, 1957, p. 178, 180.

New precipitation hardening stainless (Armco PH 15-7Mo) has high strength at supersonic speeds, can be easily fabricated, then hardened by heat treatment, costs 1/10 as much as high-strength titanium alloys; will be used chiefly for skins and major structural parts. (T24, 17-57; SS)

7-T. Use of Newer Metals in Chemical Processing Materials of Construction. *Chemical Age,* v. 78, Sept. 28, 1957, p. 449-500.

Newer nuclear uses of Zr, Hf, Cb, Ta. (T29, T10, 17-57; Zr, Cb, Ta, Hf)

8-T. Noble Metals in Chemical Engineering — Platinum, Palladium and Silver. *Chemical Age,* v. 78, Sept. 28, 1957, p. 501-502.

(T29, 17-57; Ag, Pd, Pt)

9-T. Mg Chemical and Metallurgical Uses Grow. C. K. Bjork and P. F. George. *Chemical and Engineering News,* v. 35, p. 72-76.

(T general, 17-57; Mg)

10-T. An Appraisal of Ceramic Cutting Tools. R. C. Brewer. *Engineers' Digest,* v. 18, Sept. 1957, p. 381-386, 418.

Components, porosity and grain size requirements of ceramic materials for cutting tools; use of alumina-based materials for practical tools. Wear resistance, tool life, power requirements and tool forces, surface roughness of machined part, types of work that can be performed most successfully by ceramic tools, given proper machining conditions. 7 ref. (T6n, 17-57; SGA-j, 6-70)

11-T. America's "Automatic Factory". *Metalworking Production,* v. 101, Oct. 25, 1957, p. 1907-1915.

Timken's compared to Moscow's bearing plant. (T7d; 1-61, 18-67)

12-T. (German.) **New System for Construction of Vehicles With Aluminium Semifinished Products.** F. W. H. Suppus. *Aluminium,* v. 33, Sept. 1957, p. 579-584.

The "Evimont" assembly system combines sheet and sectional metal in which the structural parts are clamped to each other by screws. The joints withstand considerable sheer stress. (T21e, K13p; Al, 17-57)

13-T. (German.) **Aluminium in a Double-Decker Bus.** P. Krekel. *Aluminium,* v. 33, Sept. 1957, p. 585-588.

(T21d, 17-57; Al)

14-T. (German.) **Insect Resistance of Aluminium and Compound Aluminium-Plastic Foils.** E. Lowig and K. Broockmann. *Aluminium,* v. 33, Oct. 1957, p. 649-654.

Insect-resistant packing of aluminum foil combined with paper or plastic. 5 ref. (T10g, 17-57; Al, 4-56)

15-T. (German.) **The AC-Line, Automatic Line for the Manufacture of Cans.** A. Klutmann and A. V. Lovell. *Aluminium,* v. 33, Oct. 1957, p. 655-658.

(T29; Al)

16-T. (German.) **European Aerosol Cans of Aluminium.** A. Taranger. *Aluminium,* v. 33, Oct. 1957, p. 659-662.

(T29, 17-57; Al)

17-T. (German.) **New Application for Aluminium in Hard Foil Packaging.** H. D. Arnold. *Aluminium,* v. 33, Oct. 1957, p. 662-664.

Production by drawing or folding of the hard foil; applications in food packaging industry. (T10g, 17-57; Al, 4-56)

18-T. (German.) **From Wire to Cold Formed Screws of High Tensile Strength.** A. Hancke. *Draht,* v. 8, Aug. 1957, p. 289-291.

Historical survey of the development of screw production during the last 50 years. (T7f, A2)

19-T. (German.) **Brass as Material for Screws.** K. Schimz. *Metall,* v. 11, Sept. 1957, p. 743-746.

Brass must be selected according to whether the screw is produced by cold forming process or by metal removal. Lead in combination with beta solid solution brass is suitable for utilization on automatics. Alpha brass is perferable for cold forming processes, which increase the yield point and the tensile strength but add to the brittleness. Recrystallization annealing brings back the original properties. Annealing temperature depends on the degree of previous cold deformation. 5 ref. (T5f, G17, G12, 17-57; Cu-n)

20-T. (Polish.) **Transformer Steel Sheet of Permalloy Type.** J. Rusz and W. Babinski. *Hutnik,* v. 24, July-Aug. 1957, p. 302-304.

Survey of products made in the Experimental Research Center of the Nonferrous Metals Institute in Poland. (T general, 17-57; AY, SGA-r)

21-T. Stainless Hopper Cars Stand Long Service. J. Halbig and R. K. Thompson. *Iron Age,* v. 180, Oct. 17, 1957, p. 118-119.

Hopper cars made from Type 410 stainless steel inspected after 20 years of continuous coal hauling. (T23p, 17-57; SS)

22-T. Selecting Friction Materials. Pt. 2. Resilient and Metallic Materials. Property Comparison Data. Elwin J. Salter. *Materials in Design Engineering,* v. 46, Nov. 1957, p. 134-137.

For automotive, industrial and aircraft applications. Covers semimetallic, cerametallic and metallic material. (T21c, T24c; 17-57; SGA-m, SGA-c)

23-T. Materials for Gears. Norman E. Woldman. *Materials in Design Engineering,* v. 46, Nov. 1957, p. 149-164.

Selection factors. Data on steel, gray cast iron, nodular iron, bronzes, metal powder and nonmetallics. (T7a, 17-57; ST, CI-n, CI-r, Cu-s, Fe, 6)

24-T.* Present Utilization of Titanium. *Metal Progress,* v. 72, Nov. 1957, p. 93-96.

Still too costly for common use, titanium and its alloys are finding many military and civilian applications where high material costs can be justified by the advantages obtained. Greater uniformity of properties, variety of alloys available, lower cost and added user experience point to a steady increase in titanium's future acceptance. (T24, T29, T2, 17-57; Ti)

25-T.* Alloys for Precious Metal Jewerly. Ralph H. Atkinson. *Metal Progress,* v. 72, Nov. 1957, p. 107-111.

Although an integral part of the broad field of metalworking, the precious metal jewelry manufacturing industry has developed its own unique materials and processes. Describes the metals most frequently used by that industry. (T9s, 17-57; Au, Ag, EG-c)

26-T. Tool Steels for the Moulding of Plastics. C. C. Hanson. *Metallurgia,* v. 56, Sept. 1957, p. 109-114.

Compares wear resistance, toughness, depth of hardening, risk of distortion, machinability, strain resistance, hardness of several commonly used die steels for plastics molding. (T6r, W24n; TS-b)

27-T. Automatic Factories. Pt. 2. Peter Trippe. *Metalworking Production,* v. 101, Nov. 8, 1957, p. 1995-2005.

British Timken compared to American and Russian bearing plants. (T7d, 1-11, 18-17)

28-T. History of the Railway Axle. From Faggotted Wrought Iron to Forged Steel. *Metallurgia,* v. 56, Nov. 1957, p. 229-230.

(T23, 17-57; Fe-m, ST)

29-T. Aluminum Use in Cars Goes Up. C. E. Morphew. *SAE Journal,* v. 65, Oct. 1957, p. 62.

(T21, 17-57; Al)

30-T. Trends of Stainless Steel. *Steel,* v. 141, Nov. 4, 1957, p. 107-122.

American producers and forms they make; present application and future uses of stainless in the automotive, aircraft and railroad industries, in home appliances, food processing equipment, hospital equipment, building—industrial, petroleum, textile and chemical industries, in

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the field of atomic industry and as fasteners. Types of stainless and their composition, fabrication, machining, forging, casting or powder part production.
(T general, 17-57; SS)

31-T. Development and Testing of Cemented Tungsten Carbide Tipped Drill Steels. Pt. 1. Development of Integral Drill Steel. Pt. 2. Testing. *University of Missouri, School of Mines and Metallurgy, 2nd Annual Symposium on Mining Research.* Curt Dahlin. Technical Series, no. 94, 1957, p. 67-92.

Design and dimension of integral drill steels; properties of cemented tungsten carbide; brazing technique, brazing alloys; drill steels and their mechanical properties; Swedish testing of steels under laboratory control conditions but with regular standard production equipment at Swedish and South African Mines by Sandvik Steel Works. 6 ref.
(T6n, 17-57; TS, W, 6-69)

32-T. (German.) **Lubrication and Design of Sleeve Bearings. Pt. 2.** Karl Droste. *Stahl und Eisen,* v. 77, Sept. 1957, p. 1196-1204.

Bearing characteristics, configuration of the sliding space and bearing materials. 23 ref. (T7d, 18-73, 17-51)

W Plant Equipment

1-W. (German.) **Synthetic Resin Cores.** F. Paschke. *Giesserei Praxis,* v. 75, Sept. 10, 1957, p. 369-373.

Resins available; equipment necessary; operation; advantages; economics. (W19g; NM-f45)

2-W. (German.) **Fabrication of Two Patterns for Rolling Mill Housings.** Friedrich Lamm. *Giesserei,* v. 44, Aug. 29, 1957, p. 520-522.

Report No. 2 of the Technical Committee on "Pattern Making" of the Verein Deutscher Giessereifachleute; pattern design; cost analysis. (W23m, 17-51; ST)

3-W. (German.) **Steel Structure in Power Industry.** Fritz Reinitzhuber. *Schweisstechnik,* v. 11, July 1957, p. 73-80.

Pressure conduits and shafts; harbor constructions; hydro-power stations; steel poles; development of arc welding technique.
(W11, 17-57, K1; ST)

4-W. (Russian.) **Improved Location of Blast Furnace Mixing Valves.** N. N. Chernov, I. F. Domnitskii and I. A. Suchkov. *Stal',* v. 17, May 1957, p. 389-391.

By placing the mixing valves between the blast furnace and the first stove the performance of the hot blast brick lining was considerably improved and the mixture of cold and hot air became satisfactory. (W17g, 1-52; RM-h, Fe)

5-W. (Russian.) **Comparison of Tilting and Stationary Openhearth Furnaces.** V. V. Leporskii, E. A. Kapustin, G. M. Glinkov and P. N. Slepkanev. *Stal',* v. 17, May 1957, p. 411-413.

In view of the ever-broadening use of high-phosphorus ores and ores with alloying constituents, the authors compare the characteristics of the two types of furnaces. 5 ref. (W18r, 1-52; ST, RM-n)

6-W. (Russian.) **Determination of Minimum Power Consumption in the Electric Arc Furnace.** N. A. Markov. *Stal',* v. 17, May 1957, p. 419-424.

Mathematical analysis of power consumption and other performance data. 8 ref. (W18s, 16-61)

7-W. (Russian.) **Improved Pass Design for Cold Rolling Pipe.** Yu. F. Shevakin, Ya. E. Osada, O. A. Semenov and F. S. Seidaliev. *Stal',* v. 17, May 1957, p. 441-444.

The Moscow Steel Institute has developed a method for designing rolls for cold rolling pipe (or tubes) which combines the most favorable gorge angle with advantages resulting from rolling pipe on low-taper mandrels. 5 ref. (W23k, 17-51; 4-60)

8-W. (Russian.) **Production of Rolls With Cast Profiles.** A. E. Krivosheev and B. B. Ezerskii. *Stal',* v. 17, July 1957, p. 663-665.

Method is claimed to be the only successful one in the world for manufacture of durable cast rolls. 3 ref. (W23k, E general; CI)

9-W. New Mill Ups Tube Production. *Steel,* v. 141, Nov. 18, 1957, p. 214-215.

Automatic tubemaking featuring outsize drawbench. (W18h, 1-52; Cu)

10-W. (Czech.) **Quality Improvement of Lubricating Asphalt for Roll Necks in Rolling Mills Designed for Thin Sheet.** Bohuslav Otta and Josef Teindl. *Hutnicke Listy,* v. 12, Sept. 1957, p. 803-808.
(W23c, 1-52; NM-h)

11-W. (German.) **Aluminum as Reactor Material.** J. Staehelin. *Metall,* v. 9, Sept. 1957, p. 746-752.

Aluminum, like magnesium, compared to other reactor materials, behaves remarkably well. A life table of Al and alloys, as compared with other reactor materials. Metal, water, organic liquid and gas cooling. Thermal conductivity, corrosion, shielding of fission products and radiation damage. (W11p, 17-57; Al)

12-W. (German.) **Materials for Heat Conductors in High-Temperature Furnaces.** R. Kieffer and F. Benesovsky. *Planseeberichte für Pulvermetallurgie,* v. 5, Aug. 1957, p. 56-71.

Physical properties of metallic heat conductors (Mo, W, Ta, $MoSi_2$); their behavior in different atmospheres and toward various ceramic materials; applications in different types of furnaces. 22 ref.
(W27p, P11h, 17-57; Mo, W, Ta)

13-W. (German.) **Life of Pig Iron Mixer Lining.** Alfred Latour. *Stahl und Eisen,* v. 77, Aug. 22, 1957, p. 1122-1126.

Life of single mixer extended by grinding the surfaces of the bricks and dry walls; provision of an expansion joint; ample heating-up time; stiffening of the filling and discharge opening and lining of the mixer; control of most troublesome spots by temperature measurements. (W18n, 1-52; RM-h)

14-W. (German.) **New Methods of Cooling by Water.** Rudolf Vonnemann. *Stahl und Eisen,* v. 77, Aug. 22, 1957, p. 1126-1135.

Reduced water consumption by natural circulation; steam discharge in the cooling system; pressure; application to heating and melting furnaces, blast furnaces, converter stacks, horizontal cooling elements. (W10f, 1-52)

15-W. (Polish.) **Application of Cold Rolled Transformer Steel Sheet in Design of Electric Machines.** A. Sliwowa. *Hutnik,* v. 24, July-Aug. 1957, p. 304-311.

Standards, properties and application; design problems. 10 ref.
(W11q, W11r, 17-57; SGA-r, AY)

16-W. (Russian.) **Selection of Checkers for Intensive Heating Recuperators.** I. D. Kirichenko. *Metallurg,* v. 2, July 1957, p. 7-10.

Design and characteristics of two types. (W17g)

17-W. Ceramic Crucible for Melting Titanium. B. C. Weber, et al. *American Ceramic Society, Journal,* v. 40, Nov. 1957, p. 363-373. (CMA)

Modified oxygen-deficient zirconia. 16 ref. (W18c, E10p; Ti, Nm-40)

18-W. A Swedish Non-Ferrous Foundry. *Foundry Trade Journal,* v. 103, Nov. 21, 1957, p. 609-612.

Equipment and methods in use at Broderna Soderberg, Sweden.
(W18, W19, E general)

19-W. Rolling Mill Spindle Maintenance at Gary Steel Works. I. D. Pottorf and Russell H. Davis. *Iron and Steel Engineer,* v. 34, Sept. 1957, p. 79-84.
(W23n; 18-71)

20-W. Standards and Classification of Lubricant for Steel Mills. J. D. Lykins. *Iron and Steel Engineer,* v. 34, Sept. 1957, p. 101-104.
(W10; NM-h)

21-W. Silicone Lubricants for the Steel Industry. W. H. Ragborg and W. H. Badger. *Iron and Steel Engineer,* v. 34, Sept. 1957, p. 105-108.

Properties of silicone fluids, silicone greases and application of silicone in the steel industry.
(W10; NM-h)

22-W. Revaluation of the 84-In. Plate Mill Modernized at Alan Wood. Frank J. Bampton. *Iron and Steel Engineer,* v. 34, Sept. 1957, p. 113-116.
(W23b; ST)

23-W.* Bottoms for Basic Open Hearth Furnaces. Stephen Wortman. *Iron and Steel Engineer,* v. 34, Nov. 1957, p. 127-133.

Construction and maintenance; types of hearth construction; materials commonly used.
(W18r, 1-65; RM-h)

24-W. Electric Drive Systems for Bar and Rod Mill Shears. A. J. White and J. A. Read. *Iron and Steel Engineer,* v. 34, Sept. 1957, p. 166-173.

General information on operation of shear; need for balance between design of shear and its electrical drive problems. (W23d, F29q, 1-53)

25-W. Proposal for a Self-Lining Blast-Furnace. W. A. Archibald, T. P. Brown and L. A. Leonard. *Iron and Steel Institute, Journal,* v. 187, Sept. 1957, p. 32-45.

Studies of flow of granules through blast furnace by means of models, proposed system of blast furnace construction to counteract wear, scaffolds and hanging. Characteristics of this design are water-cooled shafts to take advantage of refractiveness of burden and stack tuyeres. 5 ref. (W17g; ST)

26-W.* Low-Shaft Blast Furnace Adds New Promise. F. Weston Starratt. *Journal of Metals,* v. 9, Nov. 1957, p. 1432-1434.

Basic idea of the Demag-Humbolt furnace is the simultaneous carbonization and reduction of briquettes made of a mixture of proper composition—ore fines and finely ground ores, fluxes and noncoking bituminous coal with 30 to 35% volatile matter to meet the demands of the desired type of pig. (W17h, 1-52; CI-a)

27-W.* Rotor Steelmaking Process. Rudolf Graef, Walther Dick and Ludwig Von Bogdandy. *Journal of Metals*, v. 9, Nov. 1957, p. 1435-1439.

Rotary furnace at Oberhausen, Germany, is sufficiently large to receive the whole tap of the adjoining blast furnace, amounting to 60 tons. Estimated capital and operating costs; future prospects. 3 ref. (W18b, 1-52; ST)

28-W.* Case Studies in Cast and Rammed Arc-Furnace Roofs. J. D. McCullough. *Journal of Metals*, v. 9, Dec. 1957, p. 1521-1524.

Monolithic constructions in center sections of arc-furnace roofs have proven a practical method of reducing refractory roof costs, offering maximum economy when either rammed or cast. Avoiding laminations and insuring volume stability are important considerations. (W18s; RM-h, ST)

29-W. Analysis of Arc Furnace Control. J. H. Kogen. *Journal of Metals*, v. 9, Dec. 1957, p. 1525-1528.

Arc current and arc voltage are measured by means of current and potential transformers. An actuator is mechanically coupled to the electrode mast and positions the electrode until the desired balance between current and voltage is obtained. (W18s, T1m, 1-52)

30-W.* Metallurgy of EBWR. Karl F. Smith. *Metal Progress*, v. 72, Nov. 1957, p. 79-83.

Development of first experimental boiling water reactor created several metallurgical problems not previously encountered in atomic energy utilization. In finding solutions, Argonne National Laboratory developed new alloys and new fabricating techniques. (W11p, T11, 17-57; U, Zr, ST, SS)

31-W. New Arc Furnace Has 66-KV. Transformer With On-Load Tap Changing. *Metallurgia*, v. 56, Nov. 1957, p. 242-243.

At the Stocksbridge works of Samuel Fox & Co., Ltd. (W18s, D5; ST)

32-W. Plastic Press Dies Reduce Aircraft Production Cost. Joseph J. Mele. *Modern Industrial Press*, v. 19, Nov. 1957, p. 20-21.

Procedure used in making epoxy forming die. (W24n; NM-d)

33-W. Efficient Casting Is Done Best With Proper Temperature Control Equipment. Nicholas A. Jannetto. *Precision Metal Molding*, v. 15, Dec. 1957, p. 76-79.

(W19f, X9; Al)

34-W. New Mill Will Roll Tough Steels. *Steel*, v. 141, Dec. 2, 1957, p. 99-100.

Cogging mill with diamond grooved rolls proves to be best way to roll high-speed steels and superalloys. (W23a, F23n; TS, SS)

35-W. Vacuum Crane Speeds Mill Output. *Steel*, v. 141, Dec. 2, 1957, p. 102-105.

Automatic lift avoids scratches and controls cycling time on stainless steel sheets at Atlas plant. (W12q, F23, 4-53; SS)

36-W. Grinding Wheels Need Care for Best Service and Life. *Welding Engineer*, v. 42, Dec. 1957, p. 74-78.

Inspection, storage, mounting, speed control. (W25s)

37-W. Electric Roller Hearth Furnaces. *Wild Barfield Heat-Treatment Journal*, v. 6, Sept. 1957, p. 10-14.

Equipment, advantages of roller hearth and versatility in heat treating variety of ferrous and nonferrous parts. Common applications include annealing tubes, sections and strips or bars. (W27j)

38-W. Tests Carried Out on Diamond Wire-Drawing Dies. Pt. 2. *Wire Industry*, v. 24, Oct. 1957, p. 945-953.

Assessment of diamond wire drawing dies and their performance in drawing Cu wire. (W24n; Cu, 4-11)

39-W. (French.) **Contribution to the Study of Rolling Mill Equipment. Pt. 2. (Continued.) Equipment for Rolling Semifinished Products.** G. Grenier. *Echo des Mines et de la Metallurgie*, no. 3508, Sept. 1957, p. 521-523.

Types of equipment used 1920-1935 in U. S. and Europe; present types; comparison of continuous rolling mill and in-line mill, with reference to operating conditions, equipment, procedure. (To be continued.) (W23)

40-W. (French.) **Several Types of Cowper Heat Accumulators.** D. Sanna and M. Pasquet. *Institut de Recherche de la Sidérurgie*, Ser. A, no. 130, Oct. 1957, p. 1-67.

The heat accumulation is worthwhile as long as the wind temperature required by the furnace is maintained at a moderate value. The cowpers are too powerful for the requirements of blast furnaces. 29 ref. (W17m)

41-W. (German.) **Shallow Millers for Surface Milling.** A. Ringel. *Fertigungstechnik*, v. 7, Aug. 1957, p. 374-378.

Operation, advantages, economy, applications. 2 ref. (W25r)

42-W. (German.) **Design Changes in a Pusher-Type Furnace of a Three-High Mill.** Günther Barth. *Stahl und Eisen*, v. 77, Oct. 1957, p. 1459-1464.

Blast furnace gas firing, automation, instrumentation, measuring by Venturi tubes, construction of preheating furnace. 3 ref. (W20h)

43-W. (German.) **New Wire Rod Mill of the Klockner—Huttenwerk Haspe at Hagen-Haspe.** Arthur Weyel and Hans Weide. *Stahl und Eisen*, v. 77, Oct. 1957, p. 1464-1476.

(W23d, F23)

X Instrumentation

Laboratory and Control Equipment

1-X. Nickel Alloys With Special Properties. C. Gordon Smith. *Birmingham Metallurgical Society, Journal*, v. 37, Sept. 1957, p. 553-565.

Ni and Ni-Fe alloys, their use because of low expansion properties in instruments, temperature control devices and glass-to-metal seals. Constant modulus alloys for watch hairsprings and magnetic alloys for permanent magnets and ultrasonic applications. (X general, 17-57; SGA-s, SGA-b, SGA-n, Ni)

2-X. Primary Elements for Temperature Measurement. H. G. Oughton. *Instrument Engineer*, v. 2, Oct. 1957, p. 76-82.

Construction and performance features of temperature-sensitive elements of resistance thermometer, thermocouple and radiation pyrometer types. (X9, 1-52)

3-X. (German.) **Trend in Design of Force Measuring Instruments on Testing Equipment.** G. Sachs. *Draht*, v. 8, Aug. 1957, p. 352-357.

Principles and systems for measuring forces in testing; combinations of hydraulic, mechanical and electric indicating mechanisms; magnitude of forces and desired precision of measurement determine the selection of the equipment. 5 ref. (X29, 17-51)

4-X. (Polish.) **Magnetic Plates in Telecommunication Industry.** T. Konopinski. *Hutnik*, v. 24, July-Aug. 1957, p. 311-317.

Ferrosilicon, ferronickel, ferrocobalt and ferroaluminum plates, their properties and application in telecommunication industry. 30 ref. (X15p, 17-57; SGA-n)

5-X. (Polish.) **Wound Cores and Cut-Out Patterns for Telecommunication Uses.** T. Konopinski. *Hutnik*, v. 24, July-Aug. 1957, p. 317-323.

Characteristics and application of ring, tape and plate cores. Problems of plate thickness and insulation selection for most suitable core shapes. 12 ref. (X15p, 17-7; SGA-n)

6-X. (Polish.) **Device for Measuring Power Loss of Continuous Transformer Plates.** J. Siewierski. *Hutnik*, v. 24, July-Aug. 1957, p. 333-334.

Basic characteristics of device built at Institute of Iron Metallurgy in Poland. 2 ref. (X26; SGA-r, AY)

7-X. Easier Check on Surface Finish. *British Steelmaker*, v. 23, Oct. 1957, p. 312-313.

Interference microscope for assessing metal surfaces easily estimates surface irregularities to 1 micro in. (X3q, S15)

8-X. Control of Atmosphere Generators. R. R. Swain. *Iron and Steel Engineer*, v. 34, Sept. 1957, p. 152-159.

Methods of sampling, measurement, analysis and control for exothermic and endothermic generators. Instruments for use with exothermic generator include fuel-air ratio meter, gas flow meter, specific gravity meter, combustibles analyzer and recording indicators and controllers; instruments used with endothermic generators include carbon dioxide and dew point analyzers. (X7g, X7j, W28q)

9-X.* An Apparatus for Measurement of the Occlusion of Hydrogen by Metals. M. Kotyk, J. K. Magor and H. M. Davis. *Metallurgia*, v. 56, Sept. 1957, p. 153-155.

Apparatus for determining amount of hydrogen occluded at various temperatures. 6 ref. (X21; H)

10-X. (French.) **Gamma Ray Device for the Detection of Cavities in Half-Run Products at Rolling Temperature.** A. Kohn. *Institut de Recherche de la Sidérurgie*, Publications, v. A, no. 163, July 1957, p. 1-23.

Device detects the large defects inside thick rolled products passing continuously from the roller through hard gamma radiation provided by a radiocobalt source. Measurements are made by new scintillation counter. 2 ref. (X8, X2, S19, W23)

11-X. (French.) **Instrument for Static Tests and Triaxial Stress Fatigue Tests.** G. Welter and A. Choquet. *Métaux-Corrosion-Industrie*, no. 383-384, July-Aug. 1957, p. 300-312.

Theory of deformation for tridimensional stress required experimental confirmation. Description of new instrument. 5 ref. (X29, Q27, Q7, 1-53)

12-X. (Russian.) **Electronographic Analysis in the Study of Metals.** M. I. Tsipin. *Metallobedenie i Obrabotka Metallov*, no. 5, May 1957, p. 62-64.

Instrument for study of molecular structures. (X3)

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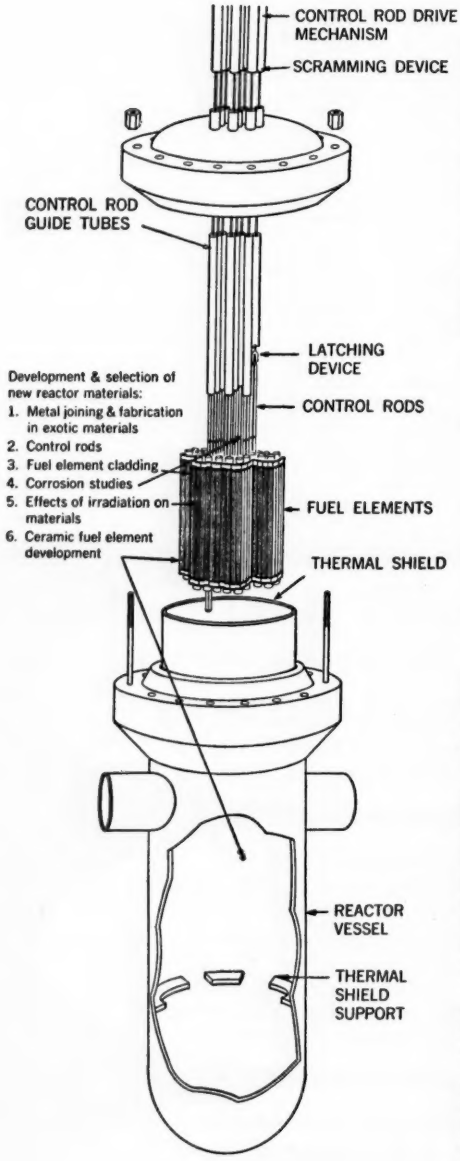

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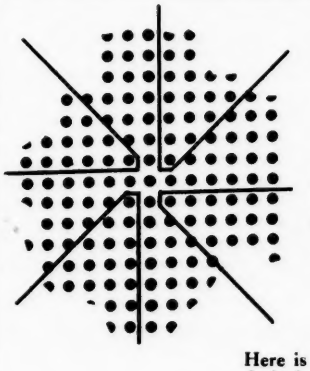

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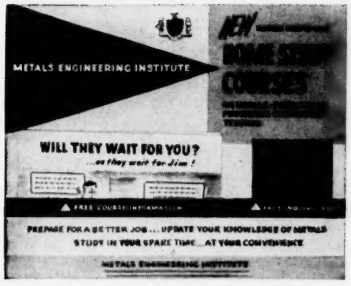
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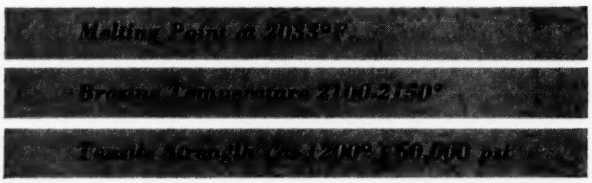

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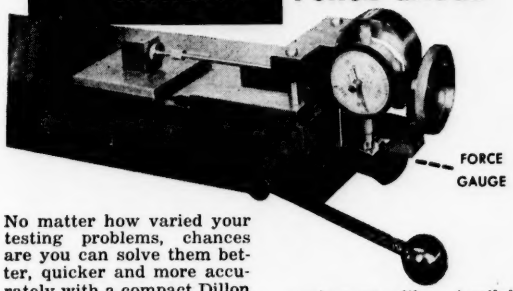

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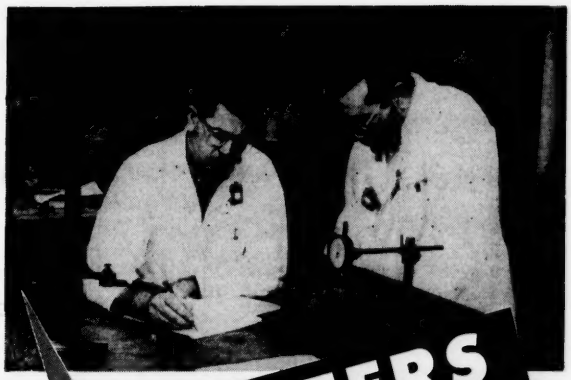

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Two alternative methods are:

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Over two million people live and work within a day's drive of Dallas. They are your prospects, interested in all that's new and improved. This is a chance you can't afford to miss.

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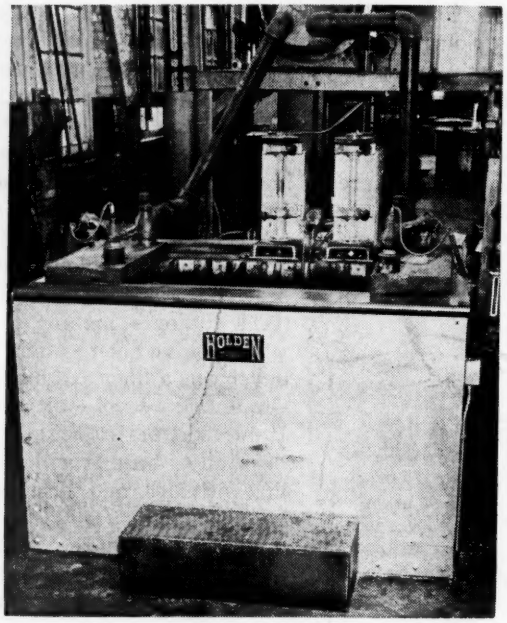
METHODS OF FINANCING INDUSTRIAL EQUIPMENT INSTALLATIONS



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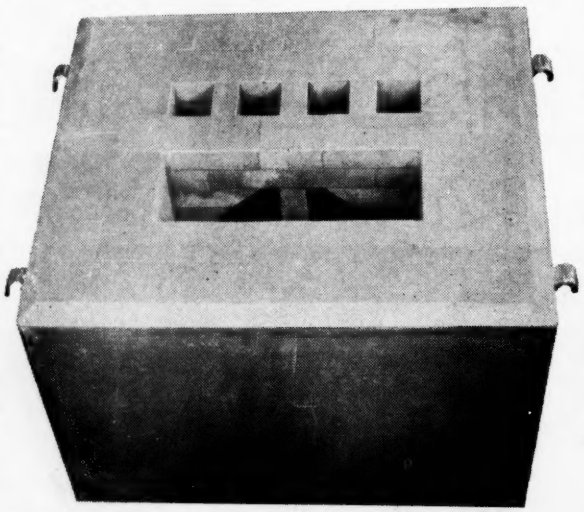
Gas Fired Marquenching-Austempering

HOLDEN—TYPE 701
Inner Furnace Assembly 1000° F to 2300° F



1. A Conditional Sales Contract
2. Sum of the Digits or Declining Balance Methods
3. Leasing or Renting

DIRECT COST AS FOLLOWS:

1. Conditional Sales Contract or sum of the Digits plan—down payment of 25%.
2. A 2 year Conditional Sales Contract equals a 12% interest or service charge.
3. Sum of the Digits methods for 5 years equals approximately 24% interest or service charge.

WHAT IS A LEASE?

A LEASE is a contract usually for a specified rent for a term of from 2 years to 10 years. Normal LEASE terms for buildings are usually a 3 months deposit or a 6 months deposit depending on the length of the LEASE.

LEASE TERMS—INDUSTRIAL FURNACES

(2 YEAR CONTRACT)

1. There is a 12% interest or service charge for the initial 2 year LEASE.
2. At the signature of the LEASE, 3 months rent is paid.
3. There are 21 equal LEASE payments after delivery of the equipment under the LEASE.
4. In the last 60 day period of the LEASE term, the LEASE may be extended either for 1 year or for 3 years.

LEASING AND PROFITS:

1. LEASING is a direct expense without investment
2. Any other method used 25% initial down payment, plus service or interest charges.

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